Trade, Wages and Employment: an empirical analysis

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Abstract

Using data for 459 US.Manufacturing industries over the period 1958-2005, this paper examines both the relationship between Globalization, relative wages and relative employment of non-production workers and the relationship between Globalization and the change in the structure of employment within the US. Manufacturing. We find that if the wage and employment gaps were separately increased by Globalization through outsourcing strategies, total inequalities between workers tended to decrease thanks to outsourcing strategies. Our results are partly in contradiction with those found by Feenstra and Hanson (2003). The second result of the paper is the change in the structure of employment over the period 1958-2005 where two distinct effects could be observed: a quantitative and a qualitative effect. Everything else equal, through outsourcing strategies, total employment in the US. Manufacturing increased by 0.040 percentage point and the non-production share in total employment increased by 0.033 percentage point.

JEL classification: F14; F16; J31

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I. Introduction

As concerns International Economics, there exists a literature on both theoretical and empirical, which attempts to show what impact international trade has on employment and wages in developed and developing countries.

In 2009, Eurobarometer carried out a survey "Views on European Union enlargement." This survey presents the point of view of Europeans about the consequence of enlargement job losses. The result is that 56% of Europeans think that enlargement has led to job losses. The result is even higher in the countries of central Europe with 58%. (Figure 1)

Indeed, Globalization can explain an increase in wage inequality because it increases competition from low-wage countries with developed countries industries (Feenstra and Hanson 1996)

It is interesting to recall some stylized facts about the rise in wage inequality between skilled and unskilled workers.

First of all, we have been able to observe wage inequalities increased in the Northern countries since the mid-80s (Figure 2). If we look at the unemployment rate by occupation between 1988 until 2010 in the US, we can see that blue collar (unskilled workers) is relatively more affected by unemployment than white collar (skilled workers). In 1988, 8% of blue collar workers were unemployed and 3% for white-collar and in 2010, 12% of blue collar were unemployed against 5.8% for the white collar. (Figure 3).

Empirical studies (Biscourp P. and F. Kramarz (2007)) show a growth in world trade with low-wage countries, especially in manufacturing.

Besides, we can observe a growth of inequalities among skilled and unskilled workers. These authors point out that there are good reasons to believe that trade liberalization harms unskilled workers.

Indeed, there is an increase in trade with the South, which is manifested by an increase in imports of manufacturing goods from developed countries, as well as import of intermediate goods increase, adding to it a strong process deindustrialization in developed countries. From the 70s, the share of industrial value added in the United States declined. Indeed, the value added in percentage of GDP regarding the industries as a whole represented 25% in 1969 whereas it reached 14% in 2001, that is a decrease of 10 percentage points. We can observe the similar decrease over the same period as regards the manufacturing sector (figure 4).

Moreover, we can see that in 2005 the United States mainly import manufactured goods from China. They spend a bit more than 5% of GDP in the import of manufactured goods from China whereas it was 2.5% in 1990. This was a sharp increase in the import of these goods. The second country is Mexico. Estimated imports of manufactured goods from Mexico towards the US were only 2.5% in 2005 whereas they reached 1.8% in 1990. The increase between 1990 and 2005 finds its explanation in the creation of NAFTA[1]. (North American Free Trade Agreement*)* in 1994. (US International Trade) (Figure 5)

[1]The NAFTA is a free trade agreement signed in January 1994 by the United-States, Canada and Mexico. This agreement aimed to reduce tariffs in order to facilitate trade among themselves

Robert C. Feenstra (2005) shows that wage inequalities between skilled and unskilled workers rose sharply from 1980 (figure 6). Moreover, we have seen above that the share of production of manufactured goods in total output tends to decrease in developed countries. This decrease is correlated with the increase in imports of goods from developing countries. Facts are consistent with the HO theory. That theorem tells "each country will export the good that uses its abundant factor intensively".

Therefore, it is expected that developed countries export capital-intensive goods and developing countries export labor-intensive goods causing wage inequality between skilled and unskilled workers. The theory shows that at constant prices, the industrial added value of developed countries has greatly diminished. This decline is still correlated to the fact that developed countries import industrial goods from developing countries. In theory, it is expected that the wages of unskilled workers will decrease and will raise regarding skilled workers in developed countries because the relative prices for industrial goods decreased (Stolper-Samuelson theorem). Indeed, Stolper-Samuelson predicted an increase in wage inequality in the north, and fall in the south except we can observe an increase in inequality in the north and in the south.

Goldberg and Pavcnik (Jel, 2001): they studied the impact of trade liberalization on inequality in several countries of the south (Mexico, Colombia.). All these countries have made reforms in the labor market; they have established skill premiums during the 80s and 90s. We have a return to education. For example, in Mexico the level of education increased by 68% between 1987 and 1993 (Cragg and Epelbaum 1996) and by 16% in Columbia between 1986 and 1998 (Attanasio and al 2004). Thereby, we have wage inequality between skilled and unskilled workers. We realize the situation is tantamount to the one in the northern countries.

However, if the stylized facts suggest that globalization plays a role in the inequality of employment and wages, some economists suggest an exogenous factor: technological change. (Verdier & Thoenig (2003), Acemoglu (2000)), Kluger & Verhoogen (2009). These authors show there is a biased technological change in favor of skilled workers because of trade openness. Indeed, technological change led to low-qualified jobs destruction but created more qualified jobs. For example: production worker versus the technician who comes and repairs a machine or Stenographers versus computer.

In relation to these facts, the research question of the paper is as follows: To what extent is globalization held responsible for wage and employment inequalities between skilled and unskilled workers in the U.S manufacturing industries from 1958 to 2005?

The main limit of the current papers regarding that matter consists in never having wage and employment equations regressed simultaneously. Accordingly, one of our first contributions is to running simultaneously the outsourcing effect on relative wages and relative employment and thereby measuring the total inequalities as regards outsourcing effects upon relative wages and relative employment among workers. The second contribution consists in analyzing outsourcing during the 1958-2005 period in order to appreciate its effect on the total inequalities. The last contribution corresponds to the "instrumental variables method" using. This consists in purging "the outsourcing variable" supposed to be endogenous.

The objective of this paper is twofold. First off, we will simultaneously analyze the effects of outsourcing as regards relative wage and relative employment between skilled and unskilled workers. To do so, we will set up the following ratio: relative wage non-production to production workers which measures the gap regarding relative wages among workers. We will use the same method as concerns the employment: Relative employment of non-production to production workers. We will use the panel dimension of our database, the estimation methods will be: a within estimator and the instrumental variables method. Secondly, we will try to identify two effects of outsourcing regarding the change in the structure of employment within the US. Manufacturing: a quantitative and qualitative effect.

In this paper, the main results show us that (1) Outsourcing increases both the relative wage and employment inequalities between skilled and unskilled workers only when the equations are separately running (2) Outsourcing strategies have changed the structure of employment within the US. Manufacturing.

1.1. Outsourcing: what is this?

Managerial theory and International trade theory both show a different approach as regards "outsourcing". Indeed, according to Managerial theory outsourcing is focused on arbitration among the modes of organization (firm or market). The specificity of the asset is the essential element in the choice of governance structure (Williamson 1975). If the specificity of the asset is high the solution is integration vertical (make) so to avoid opportunism risks that the use of the market may represent and conversely if the specificity of the asset is low the advantage goes to the market due to economies of scale (do make do).
As concerns international trade, outsourcing means "the international division of value chains" i.e. Intermediate goods are imported to produce a final good. We will favour that definition.

1.2. Outsourcing: concrete examples

The real world is full of examples of outsourcing strategies. The first example, Nike the famous American brand shoes owns 124 subcontractors plants in China in 2004 regarding only textile part. Allowing for equipment and apparel, Nike owns 900 subcontractors plants in fifty countries and thereby employs one million workers.

Example 2: Dell, the first computer constructor in the world owns nine subcontractors plants in 2007, one is located in Limerick (Ireland). In 2008, a new plant was based in Lodz (Poland) (Crozet 2009)

Example 3: The Barbie doll is the perfect vertical specialization example as long no component is from the same place. The hair comes from Japan; the assembly (legs, arms, suit) is made in China

As regards the share of intermediate goods, we can observe that the share of intermediate goods in world trade represents 16% in 2002 whereas it was 14% in 1995 (Fontagné and al 2004) (figure 7). Similarly, Grossman and Rossi-Hansberg (2008) show both an increase in the share of imported inputs in total inputs in goods producing sectors U.S and in the share of imported inputs in Gross Output in goods producing sectors U.S between 1972 and 2012 which implicitly suggest the development in outsourcing strategies firms.(figure 8). Finally, we can notice that computer and electronic products industries import more. The imports of these industries represent 1.2 percent of GDP between 1989 and 2006 (figure 9)

The examples listed up above show that the firms go abroad to get intermediary goods so to optimize the production and reduce the production costs.

1.3. Literature Review

Economic analyses suggest two steps. In the 90's, the first empirical analysis on the Stolper-Samuelson theorem is inconclusive (There is a 20% consensus about the impact of international trade; the rest is due to technological change), the destruction of employment (less qualified) is explained by technological change that improves the effectiveness of certain jobs and by contrast destroyed some of them. By and large if technological change is accepted (by fate), the impact of globalization on job destruction is less easily accepted. Krugman (1993) thought that globalization was not responsible for job cuts in the northern countries because the theory of comparative advantage is still valid. Similarly, Feenstra and Hanson (2003) suggest three reasons why the trade seems to play a minor role in wage inequality for some economists. The first reason: Magnitude of trade. Indeed, trading flows between the United States and developing countries are too weak to generate major changes in the wage structure. Trade (export + import to GDP) ratio is not higher in 1970 compared to the one during the First World War, 6.1% of GDP in 1914 and 4.1% in 1970. The second reason: Change in the price of imports. For Lawrence and Slaughter (1994), if international trade is the main cause of the decline in the relative wages of unskilled workers, we should observe a decrease in the price of intensive goods in unskilled labor (clothes prices / other goods prices). Leamer (1998) shows that prices for apparel fell in the 70's but remain stable in the 80's. The last reason: change in the structure of employment across and within industries. According to Berman, Bound and Griliches (1994), the trade is not the dominant explanation for the relative change in wages and employment of skilled workers because the movement of wages and employment is smaller regarding the industries among themselves to the within industries. But the change that occurs within industries may be reported to trade.

In the 2000's, the analysis goes further, seeking the profound effects of international trade on the job destruction: Outsourcing and increased competition associated with trade openness enable to explain the phenomenon observed.

Indeed, Feenstra and Hanson (1996, 1998, and 2003) are the first to unveil the responsibility of trade about wage inequalities between skilled and unskilled workers. They show that

outsourcing activities of the firms have a positive and significant impact on skilled workers wages within the U.S manufacturing during the 1979-1990 period. According to their conclusion, outsourcing has a major role as well as the technological change in wage inequalities among workers.

Krugman (2008) revisits his analysis about trade effects on wage inequalities between skilled and unskilled workers. Indeed, he shows that globalization through outsourcing has a negative impact much more important compared to the previous analyses because of the US manufacturing import goods from low wages countries. These goods are made with intensive techniques in unskilled labor.

In 2009, Ebeinstein, Harrison and al, carried out a survey about offshoring American multinational firms. The main results showed that offshoring towards high wages countries was positively correlated with employment in the American multinational firms. On the contrary, offshoring towards low wages countries involved a decrease of employment level in the American multinational firms.

1.4. Outsourcing, wages and employment: A theoretical approach

This part consists in analyzing the effects of a purely theoretical point of view of outsourcing on employment and wages in both the Northern countries and the Southern countries. To do so, we recall the main results found by Feenstra and Hanson (1996) then we will discuss an extension of the model made by Grossman and Hansberg (2008). Finally, we explain our approach to empirically test the model.

The model by Feenstra and Hanson puts into perspective the effects that may result in outsourcing both employment and wages. In other words, this model says "What is done and what is not done". The model breaks down as follows:

The authors assume that to produce a final good, we must perform a number of tasks where z denotes a continuum of inputs belonging between 0 and 1. We have two countries, abundant capital home country (North) and abundant labor foreign country (South)

Moreover, we have unit costs c (w,q,r,z) as a function of z, there is the upward- sloping curve CC and c*(w*,q*,r*,z*) represent unit costs for abroad "C*C* curve". Finally, ž represents the production-sharing between the two countries.

If the home country decides to produce a good, the part of the production requires intensive use of unskilled labor, the production cost for this part will be high in the home country than in the foreign country that is assumed to be a low-wage country. Therefore, the home country will outsource this part.

We can observe several effects in both the domestic and foreign countries as a result of outsourcing:

In the home country:

→ Demand for unskilled workers decreases and demand for skilled workers rises.

→ The wages of skilled workers increase and decrease for unskilled workers.

→ We do have a widening wage inequality between skilled and unskilled workers.

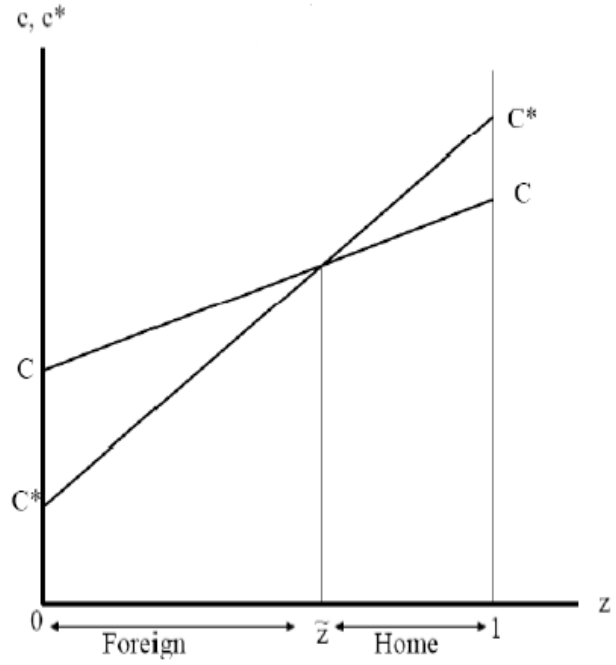
In the foreign country:

→ Demand for unskilled workers rises and demand for skilled workers decreases.

→ The wages of unskilled workers increase and decrease for skilled workers.

→ Wage inequality also increased in the country.

We can observe wage inequalities increased in the two countries.



(Source Feenstra and Hanson, 1996)

The graph[2] here above summarizes the main assumption of the model.

(1) Between 0 and ž, the foreign country produces intensive tasks in unskilled labor.
(2) Between ž and 1 the home country maintains intensive tasks in skilled labor because the relative cost as regards skilled labor is relatively cheap in the home country.

Moreover, if the home country decides to outsource a new part of the production, it means that the remaining tasks are made with highly skilled labor. (See graph below)

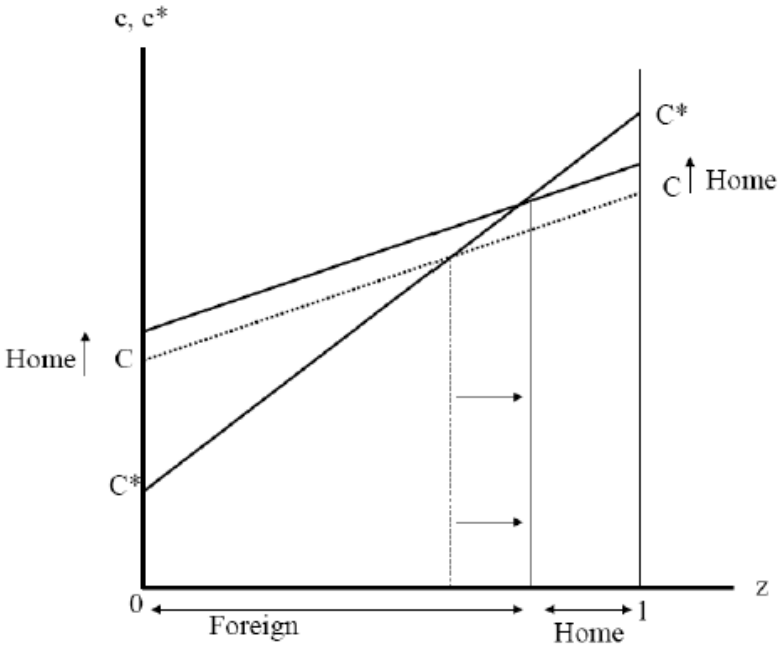
The tasks newly produced in low-wage country are more intensive in skilled labor.

In the foreign country:

→ Demand for skilled workers rises and demand for unskilled workers decreases.

→ The wages of skilled workers increase and decrease for unskilled workers.

→ We do have widening wage inequalities between skilled and unskilled workers.



The total effect of the model is as follows:

→ Due to increased outsourcing, the demand for skilled labor has increased in two countries as well as the wages of skilled workers.

→ We have an increase in wage inequalities in both countries.

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[2] The two graphs are similar to the Dornbusch-Fisher-Samuelson model (1977)

This model contradicts the prediction of Stolper-Samuelson. Moreover, the work done by Feenstra and Hanson enabled to have an alternative to the model of outsourcing.

In 2008, Grossman and Rossi-Hansberg made a model that outlined other effects of offshoring. Main assumptions of the model are as follows:

(3) Production can be divided into a continuum of tasks. (Only L-tasks can be outsourced in foreign country.)

(4) We have two types of tasks: Routine tasks and non-Routine tasks knowing that non-routine tasks are more easily relocated because these tasks require "little education" of workers.

(5) two goods are produced: X and Y.

(6) Perfect competition model.

(7) Offshoring cost of task (i) for industry j is $\alpha_{lj}\beta t_j(i)$ with $\beta t_j(i) > 1$ and $t'_j(i) > 0$, offshoring rises with i.

The paper looks at the impact of globalization, globalization leads to a decrease in β.

(8) we assume that the wages of unskilled workers are lower in the foreign country: $w > w^*$

(9) Outsourcing is a means to reduce production costs.

(10) Firms use the outsourcing strategies when $w > w^*\beta t_j(i)$

(11) In perfect competition: price ≤ cost

The authors find $pj \leq wa_{LJ}(1-/) + w^*a_{LJ} \int \beta t(i)di + sa_{HJ.}$

Where waLJ(1-/) represents cost of L-tasks performed at home country, $w^*a_{LJ} \int \beta t(i)di$ is cost of outsourced L- tasks and sa_{HJ} is cost of non-tradable tasks. If it lowers the cost of relocation, it relocates more and the average cost of the task decreases. If the cost is down prices fall. The above equation shows that the authors have found several effects. To find these effects, they replace $w = w^*\beta t_j(i)$ in the zero profit condition: $pj \leq wa_{LJ}\Omega(/) + sa_{HJ.}$ Also, they look the domestic factor market (we suppose in this model that each industry completes a fraction (1-/) of L-tasks at home country, then $(1-/)a_{lx}x + (1-/)al_y y = L \rightarrow a_{lx}x + al_y y = L/(1-/)$. Thanks to a total differentiation of the system, we have the impact of a change in β on the wages of unskilled wokers.

$\dot{W} = -\Omega + \mu_1 p - \mu_2 dl/(1-/)$. Where -Ω is productivity effect. The cost saving due to relocation benefits to low-skilled workers. Firms become more efficient this is equivalent to an improvement of the labor productivity of unskilled workers. Demand for low skilled workers rises and pushes wages-up. $\mu_1 p$ is relative price effect. We have lower costs in the intensive sector unskilled labor which leads to a Stolper-Samuelson effect i.e. reduction of wages of unskilled workers and rise of wages for skilled workers. $\mu_2 dl/(1-/)$ is Labor-supply effect. Indeed, relocation hurts unskilled workers that will involve a negative pressure on the labor market leading to lower wages for unskilled workers.

To conclude, the relocation of some tasks involves binding effects for unskilled workers such as: labor supply or relative price effect. Only the productivity effect can offset these negative effects. We can suppose that if the cost of relocation is reduced, this will benefit to both workers: skilled and unskilled workers. This may lead to an increase of unskilled wages through productivity effect in northern countries. However, the model does not tell us that some skilled jobs can be outsourced. Indeed, some skilled employment such as: programmer job can be easily offshored whereas the maintenance technician is harder for being relocatable. Thereby, the effects of globalization on employment and wages remain ambiguous.

II. Empirical methodology and Data

This section presents the empirical strategy used to estimate simultaneously the effects of outsourcing regarding the relative wages and the relative employment gap among workers and the two effects as regards the change in the structure of employment related to outsourcing.

2.1. Regression step by step

In the first part of this paper, outsourcing effects have been simultaneously tested on the relative wages and the relative employment within the US. Manufacturing industries during the 1958-2005 period. The goal is to obtain a proxy of the total outsourcing effect in relative wages and relative employment regarding skilled and unskilled workers. In order to do it, we'll run a step by step regression. We'll start with regressing a wage and employment equation inspired by Feenstra and Hanson (2003). The three equations are the following :

2.1.1. Relative Wages equation

In this subsection, we want to estimate the following equations relying on the US manufacturing industries data from 1958 to 2005. Two regressions were specified (1) with panel method and (2) with instrumental variables method.

$$(1)\Delta \log W_{it} = \beta 0 + \beta 1 \Delta \log outsourcing_{it} + \beta 2 \Delta \log X_{it} + u_{it}$$

Where $\Delta \log W_{it}$ denotes the differential between t and t-1of the relative wages[3] of non-production workers in industry i at time t, Δ log outsourcing represents the differential between t and t-1 of outsourcing in industry i at time t, $\Delta \log X_{it}$ represents the variation between t and t-1 of the explanatory variables such as: the openness-rate, technological change, high technology share, tariffs…,

3 The Relative wage measures the wage gap between skilled and unskilled workers.

$$(2)\ \Delta \log W_{it} = \beta 0 + \beta 1\ \Delta log\ outsourcing_{it} + \beta 2\ \Delta \log X_{it} + u_{it}$$

Where *outsourcing* represents the candidate variables (the differential regarding energy cost, labor cost regarding unskilled workers and capital intensity) to purge the outsourcing variable supposed to be endogenous

2.1.2. Relative employment equation

We will use the same method as concerns the employment: panel method and instrumental variables method

$$(1')\ \Delta \log N_{it} = \beta 0 + \beta 1\ \Delta \log outsourcing_{it} + \beta 2\ \Delta log\ X_{it} + u_{it}$$

Where $\Delta \log N_{it}$ denotes the differential between t and t-1 of the relative employment[4] of non-production workers in industry i at time t, $\Delta log\ X_{it}$ represents the differential between t and t-1 of the explanatory variables such as: the openness-rate, technological change, high technology share, tariff

$$(2')\ \Delta \log N_{it} = \beta 0 + \beta 1\ \Delta \log outsourcing + \beta 2\ \Delta \log X_{it} + u_{it}$$

Where $outsourcing_{it}$ represents the same candidate variables, $\Delta\ Xi$ represents all our explanatory variables such as: outsourcing, the openness-rate, technological change, high technology share, tariffs

4 the relative employment measures the employment gap between skilled and unskilled workers.

2.1.3. The last stage

In this subsection, we estimate the equations of wages and employment simultaneously, thereby we can measure total inequalities regarding outsourcing effects on relative wages and relative employment among workers. The equation is the following:

$$(1'') \; \Delta \log W_{it}/N_{it} = \beta 0 + \beta 1 \Delta \log outsourcing_{it} + \beta 2 \Delta \log X_{it} + u_{it}$$

Where the dependent variable represents the differential between t and t-1 of the total outsourcing effect both on the relative wages and the relative employment of non-production workers in the industry i at time t, Δ log outsourcing represents the differential between t and t-1 of outsourcing in industry i at time t, $\Delta \log X_{it}$ represents the differential between t and t-1 of the explanatory variables such as:, the openness-rate, technological change, high technology share, tariffs…

$$(2'') \; \Delta \log W_{it}/N_{it} = \beta 0 + \beta 1 \Delta \log outsourcing_{it} + \beta 2 \Delta \log X_{it} + u_{it}$$

Where *outsourcing* represents the candidate variables (the differential as regards energy cost, labor cost regarding unskilled workers and capital intensity.)

2.2. *Quantitative and qualitative effect*

The second part of the paper shows two effects of outsourcing as regards the structure of employment within the US Manufacturing industries during the 1958 - 2005 period. This part is inspired by Ebeinstein, Harrison and al (2009) and Grossman and Rossi-Hansberg (2008). Ebeinstein, Harrison and al show a positive correlation between offshoring American multinational firms and employment and Grossman and Rossi-Hansberg found a labor supply effect as a result of outsourcing.

2.2.1. Quantitative effect

$$(3)\ \Delta \log Employment_{it} = \beta 0 + \beta 1\ \Delta \log outsourcing_{it} + \beta 1\ \Delta \log X_{it} + u_{it}$$

Where Δ log $employment_{it}$ represents the variation between t and t-1 of the total employment in industry i at time t, Δ log outsourcing represents the variation between t and t-1 of outsourcing in industry i at time t and $\Delta \log X_{it}$ represents the variation between t and t-1 of the explanatory variables in industry i at time t such as:, the openness-rate, the relative wage gap, the relative employment gap

2.2.2. Qualitative effect

$$(4)\ \Delta \log(Non\ production\ workers/\ employment)_{it} = \beta 0 + \beta 1\ \Delta \log outsourcing_{it} + \beta 2\ \Delta \log X_{it} + u_{it}$$

Where $\Delta \log (Non\ production\ workers/\ total\ employment)_{it}$ denotes the variation between t and t-1 of non-production workers share in total employment in industry i at time t, Δ log outsourcing represents the variation between t and t-1 of outsourcing in industry i at time t and Δ log X_{it} represents the same explanatory variables presented in the previous equation.

2.2.3. Verification of the qualitative effect

(5) $\Delta \log(\text{Production workers/ total employment})_{it} = \beta 0 + \beta 1 \, \Delta \log X_{it} + u_{it}$

Where $\Delta \log (\text{production workers/ total employment})_{it}$ represents the variation between t and t-1 of the production workers share in total employment in industry i at time t, $\Delta \log X_{it}$ represents the variation between t and t-1 of the outsourcing , wages gap and employment gap variables in industry i at time t.

2.3. Description and Construction of different variables (dependent, interest, control, instruments)

These subsections present the construction of the different variables used in our empirical research. For instance, the construction of the dependent variables and the explanatory variables such as: outsourcing and high technology share is inspired by Feenstra and Hanson (2003)

2.3.1. The dependent variables

Two methods are frequently used in literature so to approximate skilled and non-skilled job. Thereby, production workers are tantamount to non-skilled workers and non-production workers are considered as skilled workers. According to Damodar Gujarati and Lewis Dars (1972), production workers are the workers assigned in processing, assembling, packing tasks whereas non-production workers are assigned to the activities as sales, engineers, legal, and qualified technicians.

In order to determine the relative wages and the relative employment gap among workers in the US manufacturing industries, we used the same method as Feenstra and Hanson (2003). To make it, we calculated the differential relative wages and relative employment gap between t and t-1 at time t: we set up the following ratios:

$$\Delta \log W_{it} = \log\left(\frac{\text{non-production workers wages it}}{\text{production workers wages it}}\right) - \log\left(\frac{\text{non-production workers wages it\_1}}{\text{production workers wages it\_1}}\right)$$

$$\Delta \log N_{it} = \log\left(\frac{\text{non-production workers it}}{\text{production workers it}}\right) - \log\left(\frac{\text{non-production workers it\_1}}{\text{production workers it\_1}}\right)$$

$$\Delta \log W_{it}/N_{it} = \frac{\log\left(\frac{\text{non-production workers wages it}}{\text{production workers wages it}}\right) - \log\left(\frac{\text{non-production workers wages it\_1}}{\text{production workers wages it\_1}}\right)}{\log\left(\frac{\text{non-production workers it}}{\text{production workers it}}\right) - \log\left(\frac{\text{non-production workers it\_1}}{\text{production workers it\_1}}\right)}$$

Moreover to determine the quantitative effect we used *Total employment*$_{it}$ which designs all workers both skilled and unskilled in the industry i. The data are available on Nber productivity. However, the total employment variable was to be turned in the first difference with the formula as follows:

$$\Delta \text{log total employment} = \text{log total employment}_{it} - \text{log total employment}_{it}\_1$$

Finally, to determine the qualitative effect the variable was constructed as follows:

$$\Delta \text{log (non-production workers/employment} = \log\left(\frac{\text{non-production workers it}}{\text{total employment it}}\right) - \log\left(\frac{\text{non-production workers wages it}}{\text{total employment it}}\right)$$

2.3.2. The explanatory variable of interest

In order to determine the effect of the globalization to both the relative wages and the relative employment between 1958- 2005 period, we used a proxy. Indeed, the globalization has been simplified on the form of outsourcing strategies. As we could see it above, outsourcing means the international divisions of value chains i.e. Intermediate goods are imported to produce a final good.

Regarding the construction of the proxy outsourcing, the methodology used is the same as Feenstra and Hanson's (2003).Indeed, Outsourcing is measured both with the share of imported intermediate goods from abroad and with the share of imported intermediate goods from other sectors. To construct this measure, we used the output-input tables (IO US tables) for different industries in the U.S. Thanks to the input output tables, we have been able to calculate the share of imported intermediate goods from abroad (broad outsourcing), and data comes from Nber productivity. We combined this data with the data of the amount intermediate goods purchased from other sectors (census of manufactures). It enabled us to calculate the share of imported intermediate goods from inside 2-digit industry (narrow outsourcing). The combination of those data gave us a proxy for outsourcing. The construction of the proxy is the following:

$$Outsourcing_{it}\ proxy = broad\ outsourcing_{it} - narrow\ outsourcing_{it}$$

2.3.3. Control variables

We decided to control the regression for the openness-rate of each US industry. To make it, we used the standard formula of the openness-rate: $(export_{it} + import_{it})/value\ added_{it}$, where

$export_{it}$ and $import_{it}$ represent the export and import in million dollars in industry i at the time t and value $added_{it}$ represents the real value added in million dollars in industry i at the time t.

Moreover, the regression is controlled for the technological change growth rate, capital expenditure, the cost of materials and the tariffs in each industry i at time t. According to annual survey of manufactures, the cost of materials designs the direct charges actually paid or payable for goods consumed or put into production during the year, including the transport cost as well, whether these goods were purchased by some industries to other industries. The regression is also controlled for the production "*value added*" expressed in millions dollars

The last control variable is *high technology capital share*. Berndt and Morrison (1995) define high technology share as communications equipment, engineering instruments, office equipment and computers.

Regarding the construction of this variable. The methodology used is the same as Feenstra and Hanson's (2003), Berndt and Morrison's (1995) .To make it, we calculated the share of this equipment which is in million dollars in total value of capital for industry i at the time t.

2.3.4 Candidate variables to be used as instruments

We have endogeneity when the explanatory variables are not exogenous but correlated with the error term i.e. cov(Xi, εi) ≠0. In general we have three kinds of endogeneity: Error Measurement, inverse causality, Omitted variables. Our equations don't have any reverse causality problems or measurement error problems but we suspected a problem about omitted variables.

In order to purge the endogeneity of the outsourcing variable we decided to use the method of instrumental variables. The interest in using the method of instrumental variables allows in one hand to purge the variable of endogeneity and in the other hand confirms the sign and the significance of the variable outsourcing.

We selected four candidate variables to be used as instruments. Two are derived from Feenstra and Hanson's (1996) model assumptions: *cost of unskilled labor* and *capital intensity*. In order to build the variables cost of unskilled labor and capital intensity, we used the standard formula for each of the two variables.

Cost of unskilled labor$_{it}$ = W_{it}*L_{it}, where w_{it} represents the wage of production workers in the industry i at time t and L_{it} represents the number of production workers in the industry i at time t.

Capital intensive$_{it}$= $capital_{it}$ / $value\ added_{it}$, where $capital_{it}$ represents the value in million dollars of machinery used in the industry i at time t.

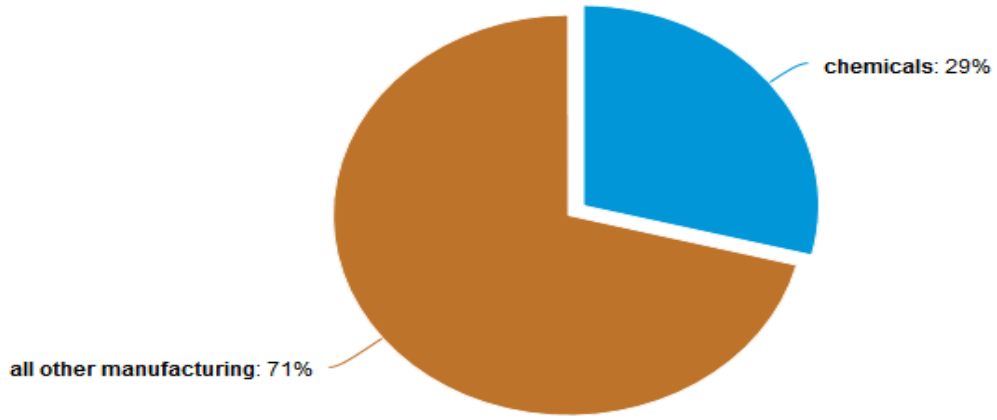
The variable *productivity of production workers* is derived from one Grossman and Rossi-Hansberg's (2008) model results as regards the productivity effect. The variable productivity of production workers was built the following way:

Productivity of production workers$_{it}$= *value added*$_{it}$/ *production workers*$_{it,}$

Where value added$_{it}$ represents the real value added in industry i at the time t and production *workers*$_{it}$ represents the number of production workers in the industry i at time t.

The last candidate variable is *the energy cost*; we didn't need to build that variable as long it is already available on Nber productivity. According to Nber productivity, the energy cost means the electricity and fuel consumption within the US manufacturing. Indeed, in order to produce manufactured goods, capital and labor are used as well as energy. For example in 2002, US energy information administration showed that chemical industries used 29% of total energy in manufactured sector, as for the rest it was consumed by the other industries (see graph below). A second graph presented in the appendix shows that machine electricity consumption in textile industry reaches 25% of total energy. Thereby, outsourcing can be a way of reducing energy costs.

Total energy consumed in U.S manufacturing,(2002)



Sources: U.S. Energy Information Administration, Manufacturing Energy Consumption Survey - Table 1.2: First Use of Energy for All Purposes (Fuel and Nonfuel), 2002

2.3.5. Data

In order to implement our empirical strategy described above, we built a panel database. We have chosen as benchmark the United-states**,** the database contains a sample of 459 manufacturing industries.

Our paper focuses in the period from 1958 until 2005. The choice of this period is deliberate because it enables us to analyze the effects of globalization in the long-run.

The construction of our database come from different sources, Nber productivity **(**Bartelsman, Becker, Gray) for 4-digit manufacturing industries information about annual industry-level data on output, non-production workers wages, payroll, total employment, non-production workers and other input costs, material cost, investment, capital stocks, total factor productivity growth rate and energy cost.

However the data regarding production workers wages and production workers employment were not previously provided by Nber productivity. In order to determine them we made the difference between the wages paid to all workers (payroll) and the wages paid to non-production workers. We used the same method to get production workers employment, that is to say: total employment minus the non-production workers.

Regarding the data for the construction of the outsourcing variable, the output-input tables (IO US tables) for the different manufacturing industries come from the Bureau of economic analysis.

Moreover, regarding the data about exports, imports and the tariffs for different industries come from Cepii.

Finally, the data for the construction of the technology share variable such as the communications equipment, engineering instruments, office equipment and computers within the US manufacturing industries come from the BLS (Bureau Labor of statistics).

III. Results of the empirical investigation of the outsourcing about the relative wage and the relative employment gap and the change in structure of the employment.

3.1. Descriptive statistics and correlations

Table A summarizes characteristics of the manufacturing industries for the 1958-2005 period. The average number of workers in the manufacturing industries is 37610 which represents an increase of 15% for the whole period. The numbers of skilled workers increased by 5.35 % while the number of unskilled workers increased by only 0.34%.

In terms of inequalities of wages and employment, the ratio of the relative wages gap of skilled workers represents as an average 1.53 which means that the relative wages gap among workers is of 53%. The wages gap increased by 6.01%. The relative employment gap of skilled workers is of 40.1% which represents an increase of 14.67%.

As concerns the outsourcing strategies of firms, the average is 38% which is an increase of 16.98% for the whole period. Moreover the openness-rate represents on average 19.2%. The growth rate of openness-rate is of 5.93 %. In terms of technological change, the average growth rate of industries is of 4.3% for the whole period. Moreover, the total capital expenditure represents 151.96 million dollars which is an increase of 12.02%. In terms of production, the value added regarding the manufacturing industries is of 2070.32 million dollars, an increase of 4.84 %. Moreover, the high technology share represents 22.8% in the total capital expenditure, an increase of 11.1 %.

In terms of energy costs within industries, on average the energy costs amount to 89.66 million dollars, an increase of 6.01%. The Cost of unskilled labor amounts to 37201.93 million dollars, an increase of 26 %. The unskilled workers' productivity is of 87.13 million dollars, an increase of 1.01%. Finally, on average the capital intensive represents for the industries 81 %, an increase of 3.54%.

The descriptive statistics show that the industries are intensive-capital and intensive skilled labor. Moreover, we can observe that the inequalities in terms of jobs or wages have risen

sharply. Similarly, the outsourcing activities also increased sharply. Thus, on the one hand we can observe a growth of inequalities between skilled workers and unskilled workers, on the other hand we notice an increase of the outsourcing strategies. The legitimate question to be asked is: is there any correlation between both phenomena?

Table b presents the correlation[5] matrix between our outsourcing variable and the dependent variables and our instrumental variables. We can see that our outsourcing variable is positively and significantly at 1% level related with each of our dependent variables except for the total inequalities variable where the relation is negative and significant at 5% level. Moreover, the correlation between the outsourcing variable and the instruments is positive and significant at 1% level except for the unskilled workers 'productivity variable where the relation is negative and significant at 5% level.

In the following section, we present the main empirical results of the effect of outsourcing on relative wages and relative employment as well as the results of the effect of outsourcing on total employment and the non-production workers share within the US manufacturing industries.

3.2 Outsourcing and relative wages of non-production workers in the manufacturing industries: 1958- 2005

Table 1 reports the results regarding the effects of the outsourcing on relative wages of non-production workers over the period 1958-2005. The estimation includes both industry fixed effects and time fixed effects. All variables are expressed in logarithms, this allows an interpretation of the results in terms of elasticity. All regressions have corrected the heteroskedasticity problem. Columns (1) to column (3) present the results of the estimate without instrumental variables.

In column (1), the estimate for outsourcing is 0.005 and is 0.004 for the openness-rate. The coefficient of outsourcing is positive and statistically significant at 1% level, the coefficient of the openness-rate is positive but not statistically significant.

[5]The correlations between the outsourcing variable and the dependent variables are plotted in the appendix

In economic terms, the coefficient of outsourcing can be interpreted as follows: Everything else equal, if outsourcing increases by 1 percentage point, the wages gap among workers will increase by 0.005 percentage point.

In the column (2), the regression is controlled by the technological change which is positive and highly significant, the technology share which is positive but not significant, the value added which is positive and significant at 1% level and the tariffs which is negative and statistically different to zero. Notice that the outsourcing variable is always positive and significant at 1% level.

In the column (3), two other control variables were added, the material cost variable which is positive and significant at 1% level and the total capital expenditure which is also positive and significant at 1% level. The coefficient of outsourcing remains positive and significant at 1% level.

In the column (4) and (5), we used the instrumental variable method. The interest is to purge the outsourcing variable of endogeneity related to omitted variables problem. The candidate variables to be used as instruments are the capital intensive, labor cost of production workers, production workers' productivity and the energy cost. In order to prove the validity of our instruments, for each column we present the Hansen test, the Weak identification test and the underidentification test.

In the column (4), the estimate for outsourcing is 0.010 and is highly statistically significant. The openness-rate variable is positive and is weakly significant. The technological change is positive and significant at 1% level. The technology share is always not significant. The estimation includes only industry fixed effects. Moreover, the result of Hansen test[6] is 0.43 and the result of weak identification[7] is 2400 and the result of underidentification is significant at 1% level. The result of the tests shows that our instruments are relevant. Moreover, the results of the first-stage[8] show a significant correlation between outsourcing and the instruments. Indeed, the correlation between the outsourcing and the energy cost is positive and significant at 5% level, the correlation between the outsourcing and the capital intensive is positive and significant at 5% level, the correlation between the outsourcing and

[6] Under the null hypothesis, the instruments are not correlated with the error term.

[7] The instruments are correlated with the endogenous regressors, but only weakly.

[8] The first stage 1 is presented in the appendix.

labor cost of production workers is positive and significant at 5% level. Finally, the correlation between the outsourcing and production workers' productivity is negative and significant at 1% level.

In the column (5), all the control variables were added, the outsourcing variable is positive and highly statistically significant, the magnitude of the coefficient increased slightly is equal to 0.011. The openness- rate has become not significant. The technological change is positive and significant at 1% level. "The tariffs" is not significant as well as the technology share.

Table 1 confirms the outsourcing strategies of the manufacturing industries over the period 1958-2005 increased the wages gap between skilled and unskilled workers. However, we can notice that the technological change played a role in widening wage inequalities. The technological change benefits to skilled workers.

3.3 Outsourcing and relative employment of non-production workers in the manufacturing industries: 1958- 2005

Table 2 focus on the effects of the outsourcing on the relative employment of non-production workers over the period 1958-2005. As previously, the estimation includes both industry fixed effects and time fixed effects. Columns (1) to column (3) present the results of the estimate without instrumental variables.

Indeed, column (1) to column (3) show that the outsourcing is positively associated with the relative employment of non-production workers. The control variables are positive and significant, the only non-significant variables are the technology share, the tariffs and the materiel cost. We can notice that the magnitude of the coefficient regarding the outsourcing is higher for the employment gap than for the wages gap. Thus, outsourcing affects harder employment compared to wages.

In the column (4) and (5), we used the instrumental variable method. The results confirm that the outsourcing impacts positively the employment share of skilled workers. The technological change still benefits to skilled workers. Moreover, the endogeneity tests show that our instruments are still relevant.

3.3 Outsourcing and total inequalities in the manufacturing industries: 1958- 2005

Table 3 reports the regression results regarding the total effect of the outsourcing on the relative wages and the relative employment. As previously, the estimation includes both industry fixed effects and time fixed effects. Columns (1) to column (3) present the results of the estimate without instrumental variables.

The main result of table 3 is the negative sign and significant at 1% level of the outsourcing variable. We find some evidence that suggests that the outsourcing separately increases wages and employment inequalities but not simultaneously. Thus, outsourcing strategies have a partial effect on inequalities. Indeed, the results show that the outsourcing reduced the total inequalities between skilled workers and unskilled workers over the period 1958-2005. The fall of total inequalities can have two feasible explanations: either it reflects a productivity effect[9] or it reflects an artificial fall as long outsourcing doesn't affect wages and employment the same way.

If the results obtained on table 1 and tables 2 confirm the standard literature about the responsibility of Globalization in widening wage inequalities and employment, table 3 provides an alternative vision of globalization. In the section that follows, we present the main results about the change in structure of the employment as result of the outsourcing.

3.4 Outsourcing and quantitative effect within the manufacturing industries: 1958- 2005

Table 4 presents the results of our estimation for the quantitative effect within the manufacturing industries over the period 1958-2005. The estimation includes both industry fixed effects and time fixed effects. Columns (1) to column (3) present the results of the estimate without instrumental variables. Furthermore, the total capital expenditure and material cost variables were replaced by wages gap and employment gap. Moreover these two new variables were not regressed in the same time as the outsourcing variable because of some correlation between them. Finally, column (4) to column (5), energy costs and production workers' productivity are the only instruments that remain valid.

[9] The productivity effect has not been demonstrated in this paper. The Grossman and Rossi-Hansberg model (2008) show that through offshoring, firms become more efficient this is equivalent to an improvement of the labor productivity of unskilled workers. Demand for low skilled workers rises and pushes wages-up.

Column (1) shows that the outsourcing is positively correlated with the total employment. The openness-rate is not statistically different to zero. The technology share is not significant and the value added is positive and significant at 1% level. The technological change is positive and highly statistically significant. The technological change contributed to increase the total employment over the period 1958-2005.

Column (2) shows that the wages gap variable is negatively and significantly correlated with the total employment. Everything else equal, if the wages gap increases by 1 percentage point, the total employment will decrease by 0.097 percentage point over the period 1958-2005. The employment gap variable is positive and significant at 1% level. Everything else equal, if the employment gap increases by 1 percentage point, the total employment will increase by 0.033 percentage point over the period 1958-2005.

Column (3) confirms that the outsourcing increased the total employment over the period 1958-2005. The tariffs and technology share variables are not significant. The technological change is always positive and significant.

In Column (4) and (5) we used the instrumental variables method, the outsourcing variable is positive and significant at 5% level. Everything else equal, if outsourcing increases by 1 percentage point, the total employment will increase by 0.040 percentage point over the period 1958-2005. We can observe that the magnitude of the coefficient is lower compared to column (3).The technological change is positive and significant at 5% level, the technological share is still not significant. The value added is positive and significant at 1% level and the tariffs variable is negative and significant at 5% level. The result of Hansen test[6] is 0.14 and the result of weak identification is 2771.83 and the result of underidentification is significant at 1% level. The result of the tests[10] shows that our instruments remain relevant.

[10] The first- stage 2 is presented in the appendix.

3.4 Outsourcing and qualitative effect within the manufacturing industries: 1958- 2005

Table 5a provides the estimate results for the qualitative effect during the period 1958-2005. We found that outsourcing strategies increased the non-production workers share within the manufacturing industries. The technological change also contributed to increase the non-production workers share. We can notice the tariffs variable is negative but weakly statistically significant.

However, in column (4), the tariffs variable is significant at 5% level but the magnitude of the coefficient is lower compared to column (3). In column (2), the wages gap and employment gap variables are positive and both significant at 1% level and 5% level. We can observe that the magnitude of the coefficient regarding the employment gap is higher compared to wages gap coefficient. Moreover we can make the same observation as regards outsourcing. Indeed, with the instrumental variables, the magnitude of the coefficient is higher compared to column (3).Everything else equal, if outsourcing increases by 1 percentage point, the non-production workers share will increase by 0.033 percentage point within the manufacturing industries for the period 1958-2005.

3.5 Outsourcing and production workers share in the manufacturing industries: 1958-2005

In part 3.4 and part 3.5, total employment was decomposed into two distinct parts: on the one hand we have non-production workers share in total employment and on the other hand we have production workers share in total employment.

Thus, table 5b shows that outsourcing strategies decreased the production workers share within the US manufacturing industries during the period 1958-2005. Everything else equal, if outsourcing increases by 1 percentage point, the production workers share will decrease by 0.023 percentage point. Without instrumental variables, everything else equal, the production workers share will decrease by 0.008 percentage point. Only employment gap variable increased production workers share in total employment. The results found are consistent with the stylized facts described in the literature.

It is clear that outsourcing strategies have changed the structure of employment within the manufacturing industries on the period 1958-2005. We can notice that quantitative effect finds its explanation from qualitative effect. In section that follows, we performed a robustness check and a stability test in order to prove that the increase or decrease of wage gap and employment gap have followed the progress of outsourcing strategies.

Robustness Checks and Stability Test

Stylized facts that are presented in the introduction show a growth of wage and employment gap in the US from the mid 1980's.

Our robustness checks consists in estimating outsourcing effect on wage and employment gap for two sub-periods: 1958-1983 and 1983-2005. By our descriptive statistics, outsourcing strategies between 1958 and 1983 increased by 8.27% whereas during the 1983- 2005 period outsourcing strategies increased by 21.92%. Thereby, we expect outsourcing effect to have a lower impact on the sub-period 1958-1983 compared to the sub-period 1983-2005. In addition, we performed a stability test[10] (Chow test) in order to show the outsourcing, wage, employment relationship in not stable over time.

Table 6 reports the results of the outsourcing effect on relative wages of non-production workers for two sub-periods: 1958-1983 and 1983-2005. The estimation includes both industry fixed effects and the instrumental variables. Our instrumental variables are the capital intensive, labor cost of production workers, production workers' productivity and the energy cost In order to prove the validity of our instruments, for each column we present the Hansen test, the Weak identification test and the underidentification test. All regressions have corrected the heteroskedasticity problem.

Column (1) shows the estimate for outsourcing is 0.008 and weakly significant. The openness-rate, the technological change and the technology share variables are not significant. Moreover, the result of Hansen test[6] is 0.25 and the result of weak identification[7] is 6133.58 and the result of underidentification is significant at 1% level. The result of the tests shows that our instruments are relevant.

In Column (2), the estimate for outsourcing is 0.007 but always weakly significant. The openness-rate, the technological change, the technology share and the tariffs variables are not significant. The only significant variables are the value added, material cost and capital expenditure.

[10] Chow test is used to test the stability of the coefficients on two different subsets. Under the null hypothesis, the relation estimated is stable.

Moreover, when the control variables are added the magnitude of outsourcing coefficient decreased.The result of Hansen test[6] is 0.12 and the result of weak identification[7] is 6114.85 and the result of underidentification is significant at 1% level. The results regarding the validity of our instruments are positive.Thus, for the period 1958-1983, the impact of outsourcing on wage gap is low.

In Column (3) the estimate for outsourcing is 0.008 and significant at 5% level. Note that the significance of the outsourcing variable is already higher than previously. The technological change variable is positive and significant at 5% level. The technology share variable is not significant. The tests regarding the validity of our instruments are still positive.

In column (4) the estimate for outsourcing is 0.010 and highly significant. The technological change is positive and significant at 1 % level. The value added variable is positive and significant at 5% level. The material cost and capital expenditure variables are positive and highly significant. The tests regarding the validity of our instruments are positive. For the period 1983-2005, outsourcing strategies and technological change enable to explain the wage gap between skilled and unskilled workers. The result regarding the chow test is significant at 1% level, it means that relation estimated is not stable for the whole period.

Table 7 shows the results of the outsourcing effect on relative employment of non-production workers for two sub-periods: 1958-1983 and 1983-2005. The main result is an impact lower of the outsourcing both in terms of magnitude and significance for the sub-period 1958-1983. The chow test result is significant at 1% level. The relation estimated is not stable for the whole period.

Table 8 reports the results of the outsourcing total effect on relative wage and relative employment gap for two sub-periods: 1958-1983 and 1983-2005. The main result is an impact lower both in terms of magnitude and significance of the outsourcing regarding the decrease of total inequalities among workers for the sub-period 1958-1983. The result regarding the chow test is significant at 1% level

Table 9 summarizes the main results regarding of the outsourcing effect on total employment within the US manufacturing industries for the sub-periods 1958-1983; 1983-2005. The estimation includes industry fixed effects Moreover, energy cost and production workers' productivity are the only instruments that remain valid.

For the period 1958-2005 the outsourcing variable has a lower significance as well as the value added and the technological change have. Moreover, the chow test shows that the relation estimated is not stable for the whole period.

Table 10 reports the main results regarding the outsourcing effect on the non-production workers share. We can see a difference of both significance and magnitude as regards the variable outsourcing for the sub-periods 1958-1983; 1983-2005.Moreover, our instruments are relevant and the chow test is significant. Thus, over the period 1958-1983, the outsourcing strategies have had small effect on the non-production share within the US manufacturing industries.

The results of the robustness check show on one hand that the increase or the decrease of wage and employment gap follow outsourcing strategies progress (we obtain a decrease of the total inequalities when wage and employment gap are simultaneously regressed); on the other hand, the robustness check show that the main results obtained on the previous parts are not sensible to the sub-period 1983-2005 (as long as outsourcing is relatively high during that period). Moreover, the chow test performed shows that the relationship between outsourcing, wages and employment gap moved erratically during the 1958-2005 period.

IV Conclusion

Our empirical research enabled us to evidence that wage and employment inequalities within the U.S manufacturing industries between 1958 and 2005 were partly increased by trading tasks. Indeed, we could see that if the wage and employment gaps were separately increased by outsourcing, total inequalities between workers tended to decrease.
Moreover, outsourcing has changed the structure of employment within the US. Manufacturing industries over the period 1958-2005. Indeed, two distinct effects could be observed: a quantitative and a qualitative effect.

Outsourcing strategies enable to extract the features of manufacturing industries that use them. Those industries are capital intensive and consist of high costs regarding energy or lower skilled labor.

Thus, because of the relocation of intensive tasks regarding unskilled labor, production techniques in manufacturing industries became more intensive as regards skilled labor. Indeed, the share of skilled workers in total employment has increased by 5.35% over the period 1958-2005. That observation was carried out by Trefler(1993) and outlines that the US have one of the highest productivity in the world. Thereby the US export skill intensive goods.

Moreover, we have seen that in theory the firms have become more efficient due to the relocation of intensive tasks of unskilled labor (Grossman and Rossi-Hansberg (2008)). In perfect competition, cost savings benefitted to the employed factor and therefore it is equivalent to an increase of the productivity of unskilled workers, which is known as a productivity effect. This productivity effect can have two possible effects: downward prices which give an advantage to consumers or a relative increase in the demand for unskilled workers.

Finally, if outsourcing enables to increase production and enables to decrease costs, it may be considered as a way of exchanging production factors, especially scarce factors. According to the HOV **(**Hecksher-Ohlin Vanek) model, goods exchange is a substitute to factors exchange.

Moreover, while globalization seems responsible for the rise of employment and wage inequalities among workers, we shouldn't forget that other factors are the cause of qualified jobs. We must take into account that there is a biased technological progress in favor of skilled workers because of trade openness. Indeed, technological change led to low-qualified jobs destruction but created more qualified jobs. .

Our results show that technological change has increased the wages differential between skilled and unskilled workers by 0.007 percentage point and by 0.042 percentage point employment gap.

Thoenig and Verdier (2003) explain this phenomenon. In fact, globalization intensifies competition, firms react against foreign producers with lower costs, innovating and increasing their employment of skilled workers (defensive innovations). The test is focused towards the French industrial firms. Thus, sectors that have increased their degree of openness to trade have thereby increased the skilled Job / unskilled job ratio.

Moreover, if the north-south trade increased the inequalities in the northern countries, we can observe that it is the same in the south because of a change in the specialization. Zhu and Trefler (2005), proposed an empirical study of this phenomenon. They studied the relationship between the intensity of skilled labor exports of developing countries and wage inequalities. They have used data for 20 developing countries between 1983 and 1997. For each sector (4-digit SITC), they used U.S. data to calculate skilled labor / unskilled in production ratio. They classified the sectors depending on their intensity in skilled labor. They calculated the share of each good regarding the exports of the country towards the OECD Xit (z), and cumulative Σ0ZXit (z) shares in 1990 and 1993.

Thai exports to the OECD have become more intensive in skilled labor whereas Sri Lanka's exports to the OECD became less intensive in skilled labor. (Figure 10)

Despite our being able to discuss the reason why globalization creates winners and losers in the first part of this paper, whatever it may be that relationship is still ambiguous.

Within the field of political economy, the only legitimate question is: shall we continue to liberalize the labor market? Or on the contrary, shall we protect the workers being affected by globalization thanks to trade barriers (tariffs, quota...)? In addition, the redistribution is one more legitimate question: shall we tax globalization winners so to compensate losers?

Therefore, it would be interesting in the future research to study these questions.

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Tables and Figures

Table A Descriptive statistics

1958-2005

US Manufacturing sector	Mean	st. dev	min	max	differences %	observations
Dependent variables						
Total employment 1000s	37610	52.24	400	565400	6.38	21955
Non Production workers 1000s	27220	38.12	300	464500	5.35	21955
Production workers 1000s	10390	18.48	100	294200	0.34	21955
Non-production workers wages $1m	670.34	1310.83	3.75	21558	4.10	21955
Production workers wages $1m	418.35	829.85	3.46	16352	- 4.70	21955
Wages gap among workers ratio	1.53	0.553	0.66	3.67	6.01	21955
Employment gap among workers %	40.1	35	- 0.94	635	14.67	21955
Interest variable						
Outsourcing %	38	60	1.34	67	16.98	21743
Control variables						
Openness rate %	19.2	4	10.5	26.1	5.93	21955
Δ TFP	4.3	6.02	0.36	6.41	-	21955
Tariffs %	8	22.75	2.15	24.38	4.74	21955
Total capital expenditure in $1m	151.96	457.46	0	14583.6	12.02	21955
Cost of materials in $1m	2413.76	8352.63	7	345883.1	4.72	21955
Value added $1m	2070.32	4638.99	10.2	104711.5	4.84	21955
High technology share	22.8	36	1.32	52	11.1	21535
Candidate Instruments						
Energy costs $1m	89.66	329.09	0.1	11246.1	6.01	21955
Cost of unskilled labor $1m	37201.93	224794.5	1.95	6709473	26	21955
Cost of skilled labor $1m	12531.26	77853.44	- 0.38	2267802	20.44	21955
Production workers' productivity $	87.13	128.80	3.20	3949.018	1.01	2 1955

Non-production workers' productivity $	229.535	294.757	- 691	10282.97	5.30	21955
K/Y (capital intensive)	0.81	0.69	0.034	0.67	3.54	21955

Notes: the variables "non-production workers' productivity" and "Cost of unskilled labor" were not used as instrument. They are used as a comparative tool. Outsourcing increased by 8.27% between 1958-1983 and by 21.92 % between 1983-2005. See section 2 for definition of all variables

Table b correlation matrix

	Δlog Outsourcing	Δlog wages gap	Δlog employment gap	Δlog total inequalities	Δlog total employment
Δlog Outsourcing	1.000				
Δlog relative Wages	0.0294***	1.0000			
Δlog relative employment	0.0866***	0.0048	1.0000		
Δlog Total inequalities	- 0.0440**	0.0185	0.0184	1.0000	
Δlog Total employment	0.0265***	0.0936***	- 0.0181***	- 0.9722***	1.0000
Δlog skilled workers share	0.0499***	0.0143***	0.3455***	0.0259**	- 0.0124*
Δlog Labor cost - unskilled workers	0.6979***	- 0.0041	0.0027	- 0.0412	0.0217
Δlog Energy cost	0.0278***	0.0022	- 0.0025	- 0.0008	- 0.0014
Δlog Capital intensive	0.0289***	0.0032	- 0.0008	- 0.0041	- 0.0011
Δlog unskilled workers' productivity	- 0.0238**	- 0.0069	0.0015	- 0.0086	- 0.0094

	Δ log skilled workers share	Δ log Labor cost unskilled workers	Δ log energy cost	Δ log Capital intensive
Δlog Outsourcing				
Δlog relative wage				
Δlog relative employment				
Δlog Total inequalities				
Δlog Total employment				
Δlog skilled workers share	1.0000			
Δlog Labor cost - unskilled workers	0.0529***	1.0000		
Δlog Energy cost	- 0.0023	- 0.012	1.000	
Δlog Capital intensive	- 0.4262***	- 0.0246	0.0016	1.000
Δlog unskilled workers' productivity	- 0.0112	- 0.0057	- 0.0069	0.0013

	Δlog unskilled workers' productivity
	1.000

Note : *** p<0.01, ** p<0.05, * p<0.1

Table 1: Dependent variable: Δ Log (relative wages of non-production workers): 1958-2005

Explanatory variables	within (1)	within (2)	within (3)	IV2LS (4)	IV2LS (5)
Δ Log outsourcing	0.005***	0.009***	0.008***	0.010***	0.011***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
Δ Log openness-rate	0.004	0.012	0.015	0.019*	0.014
	(0.008)	(0.010)	(0.010)	(0.011)	(0.013)
Δ TFP		0.003*	0.004**	0.006***	0.007***
		(0.002)	(0.001)	(0.002)	(0.003)
Δ Log technology share		0.002	0.001	0.009	0.011
		(0.003)	(0.002)	(0.010)	(0.011)
Δ Log Y		0.015***	0.017**		0.014***
		(0.006)	(0.008)		(0.006)
Δ Log tariffs		- 0.001***	- 0.001***		- 0.001
		(0.002)	(0.002)		(0.002)
Δ Log material cost			0.055***		0.056***
			(0.006)		(0.006)
Δ Log Capital expenditure			0.038***		0.040***
			(0.006)		(0.005)
Constant	- 0.017	- 0.076	- 0.021		
	(0.015)	(0.031)	(0.034)		
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	no	no
R2	0.04	0.07	0.08	0.033	0.06
Observations	6321	4016	4016	2383	2383
Panel test: Hausman test FE or RE	0.0029	0.000	0.000		
IV tests: Hansen J (overidentification test of all instruments) P-val:				0.43	0.26
Weak identification (Cragg-Donald Wald F statistic)				2400	2366.76
Underidentification (Kleibergen-Paap rk LM statistic) P-val:				0.000	0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are : capital intensive, labor cost of production workers, production workers' productivity and the energy cost .All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 2: Dependent variable: Δ Log (relative employment of non-production workers): 1958-2005

Explanatory variables	within (1)	within (2)	within (3)	IV2LS (4)	IV2LS (5)
Δ Log outsourcing	0.053***	0.055***	0.053***	0.051***	0.048***
	(0.009)	(0.012)	(0.013)	(0.011)	(0.012)
Δ Log openness-rate	0.085***	0.070*	0.069*	0.064*	0.065*
	(0.028)	(0.037)	(0.037)	(0.039)	(0.038)
Δ TFP		0.006***	0.004***	0.005***	0.042***
		(0.002)	(0.001)	(0.002)	(0.001)
Δ Log technology share		0.045	0.044	0.010	0.007
		(0.030)	(0.030)	(0.018)	(0.019)
Δ Log Y		0.078***	0.071***		0.045**
		(0.021)	(0.019)		(0.022)
Δ Log tariffs		- 0.001	- 0.001		- 0.004
		(0.007)	(0.007)		(0.006)
Δ Log material cost			0.007		0.013
			(0.020)		(0.019)
Δ Log Capital expenditure			0.006***		0.059***
			(0.018)		(0.016)
Constant	0.022	- 0.116	- 0.351**		
	(0.078)	(0.132)	(0.162)		
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	no	no
R2	0.02	0.03	0.03	0.01	0.02
Observations	6322	3659	3659	3728	3714
Panel test: Hausman test FE or RE	0.03	0.01	0.06		
IV tests: Hansen J (overidentification test of all instruments) P-val:				0.37	0.23
Weak identification (Cragg-Donald Wald F statistic)				7924.55	5426.81
Underidentification (Kleibergen-Paap rk LM statistic) P-val:				0.000	0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are : capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 3: Dependent variable: Δ Log (relative wages of non- production workers/ relative employment of non-production workers): 1958-2005

Explanatory variables	within (1)	within (2)	within (3)	IV2LS (4)	IV2LS (5)
Δ Log outsourcing	- 0.025***	- 0.026***	- 0.019***	- 0.042***	- 0.036***
	(0.008)	(0.007)	(0.006)	(0.013)	(0.012)
Δ Log openness-rate	0.069*	0.058*	0.055*	0.077*	0.090***
	(0.037)	(0.031)	(0.031)	(0.042)	(0.039)
Δ TFP	0.039	0.045***	0.040***	0.052***	0.048***
	(0.011)	(0.010)	(0.009)	(0.014)	(0.013)
Δ Log technology share		0.010	0.011	0. 018	0.002
		(0.010)	(0.008)	(0.020)	(0.019)
Δ Log Y		0.041***	0.037***	0.039***	0.042***
		(0.008)	(0.007)	(0.009)	(0.007)
Δ Log tariffs			- 0.002		- 0.002
			(0.005)		(0.006)
Δ Log material cost			0.334***		0.306***
			(0.023)		(0.033)
Δ Log Capital expenditure	0 .717***	0.615***	0.373***	0.599***	0.377***
	(0.008)	(0.032)	(0.021)	(0.050)	(0.033)
Constant	- 0,704	- 0.940***	- 0.082***		
	(0.179)	(0.312)	(0.278)		
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	no	no
R2	0.76	0.81	0.84	0.78	0.81
Observations	3314	3251	3251	3246	3246
Panel test: Hausman test FE or RE	0.03	0.00	0.05		
IV tests: Hansen J (overidentification test of all instruments) P-val:				0.48	0.14
Weak identification (Cragg-Donald Wald F statistic)				2778.78	2771.83
Underidentification (Kleibergen-Paap rk LM statistic) P-val:				0.000	0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are: capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 4: Dependent variable: Δ Log (Total employment): 1958-2005

Explanatory variables	within (1)	within (2)	within (3)	IV2LS (4)	IV2LS (5)
Δ Log outsourcing	0.040***		0.066***	0.044***	0.040**
	(0.018)		(0.022)	(0.018)	(0.020)
Δ Log openness-rate	0.056	0.021	0.020	0.049	0.048
	(0.059)	(0.022)	(0.022)	(0.068)	(0.066)
Δ TFP	0.042***	0.040***	0.041***	0.027***	0.018**
	(0.053)	(0.005)	(0.015)	(0.008)	(0.009)
Δ Log technology share	0.067	0.014	0.016	0.014	0.015
	(0.055)	(0.021)	(0.022)	(0.024)	(0.024)
Δ Log Y	0.022**	0.021**	0.019***		0.032***
	(0.011)	(0.010)	(0.009)		(0.022)
Δ Log tariffs		- 0.056	- 0.052		- 0.021**
		(0.059)	(0.054)		(0.011)
Δ Log relative wages gap		- 0.097***			
		(0.016)			
Δ Log relative employment gap		0.033***			
		(0.010)			
Constant	0.008	- 0.006***	- 0.038***		
	(0.113)	(0.019)	(0.013)		
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	no	no
R2	0.32	0.92	0.93	0.513	0.62
Observations	2413	2412	2410	3995	3995
Panel test: Hausman test FE or RE	0.012	0.00	0.01		
IV tests: Hansen J (overidentification test of all instruments) P-val:				0.13	0.16
Weak identification (Cragg-Donald Wald F statistic)				31.58	23.184
Underidentification (Kleibergen-Paap rk LM statistic) P-val:				0.000	0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are: production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 5a: Dependent variable: Δ Log (Non-production workers share / total employment): 1958-2005

Explanatory variables	within (1)	within (2)	within (3)	IV2LS (4)	IV2LS (5)
Δ Log outsourcing	0.025***		0.027***	0.040***	0.033***
	(0.006)		(0.007)	(0.007)	(0.004)
Δ Log openness-rate	0.025*	0.041***	0.034***	0.042***	0.043***
	(0.013)	(0.015)	(0.014)	(0.016)	(0.017)
Δ TFP	0.034***	0.029***	0.028***	0.044***	0.034***
	(0.005)	(0.007)	(0.006)	(0.008)	(0.009)
Δ Log technology share		0.022	0.018	0.026	0.025
		(0.016)	(0.016)	(0.017)	(0.018)
Δ Log Y		0.053***	0.051***	0.068***	0.056***
		(0.014)	(0.010)	(0.019)	(0.016)
Δ Log tariffs		- 0.037*	- 0.034*		- 0.015**
		(0.023)	(0.026)		(0.007)
Δ Log relative wages gap		0.020***			
		(0.006)			
Δ Log relative employment gap		0.041**			
		(0.014)			
Constant	0.061***	0.059***	0.032***		
	(0.010)	(0.016)	(0.011)		
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	no	no	no	no	no
R2	0.03	0.02	0.06	0.78	0.80
Observations	4123	2419	2410	3996	3994
Panel test: Hausman test FE or RE	0.02	0.000	0.000		
IV tests: Hansen J (overidentification test of all instruments) P-val:				0.46	0.41
Weak identification (Cragg-Donald Wald F statistic)				20.37	18.90
Underidentification (Kleibergen-Paap rk LM statistic) P-val:					0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are: production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 5b: Dependent variable: Δ Log (production workers/ total employment): 1958-2005

Explanatory variables	within (1)	within (2)	IV2LS (5)
Δ Log outsourcing	- 0.008***		- 0.023***
	(0.003)		(0.006)
Δ Log openness-rate	- 0.006	- 0.001	- 0.007
	(0.009)	(0.006)	(0.016)
Δ TFP	- 0.014***	- 0.013	- 0.019***
	(0.006)	(0.038)	(0.007)
Δ Log technology share	- 0.020*	- 0.017*	- 0.017
	(0.011)	(0.009)	(0.007)
Δ Log Y	- 0.016***	- 0.016***	- 0.016
	(0.003)	(0.002)	(0.004)
Δ Log tariffs	0.001	0.000	0.002
	(0.002)	(0.001)	(0.002)
Δ Log relative wages gap		0.047***	
		(0.011)	
Δ Log relative employment gap		- 0.075***	
		(0.022)	
Constant	- 0.087*	- 0.012**	
	(0.048)	(0.005)	
Industry fixed effects	yes	yes	yes
Time fixed effects	yes	yes	no
R2	0.12	0.14	0.46
Observations	6094	6553	6110
Panel test: Hausman test FE or RE	0.02	0.000	
IV tests: Hansen J (overidentification test of all instruments) P-val:			0.55
Weak identification (Cragg-Donald Wald F statistic)			1505.55
Underidentification (Kleibergen-Paap rk LM statistic) P-val:			0.000

Notes. All regressions were estimated using a within estimator except for column 4 and 5 we used the 2SLS. The instruments are: production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 6: Dependent variable: Δ Log (relative wages of non-production workers)

Explanatory variables	**1958-1983**: IV2LS (1)	IV2LS (2)	**1983-2005 :** IV2LS (3)	IV2LS (4)
Δ Log outsourcing	0.008*	0.007*	0.008**	0.010***
	(0.005)	(0.005)	(0.004)	(0.004)
Δ Log openness-rate	0.002	0.003	0.006	0.001
	(0.002)	(0.013)	(0.013)	(0.012)
Δ TFP	0.003	0.002	0.005**	0.007***
	(0.003)	(0.003)	(0.003)	(0.002)
Δ Log technology share	0.002	0.002	0.002	0.004
	(0.004)	(0.004)	(0.007)	(0.007)
Δ Log Y		0.005***		0.011**
		(0 001)		(0.005)
Δ Log tariffs		- 0.003		- 0.002
		(0.003)		(0.003)
Δ Log material cost		0.062***		0.063***
		(0.010)		(0.007)
Δ Log Capital expenditure		0.005***		0.011***
		(0.001)		(0.003)
Industry fixed effects	yes	yes	yes	yes
R2	0.082	0.94	0.92	0.97
Observations	1895	1895	2140	2140
IV tests: Hansen J	0.25	0.12	0.38	0.21
Weak identification	6133.58	6114.85	4514.77	4390.28
Underidentification	0.000	0.000	0.000	0.000
Chow test		**0.000**		

Notes. All regressions were estimated using the 2SLS estimator. The instruments are: capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 7: Dependent variable: Δ Log (relative employment of non-production workers)

Explanatory variables	**1958-1983**: IV2LS (1)	IV2LS (2)	**1983-2005 :** IV2LS (3)	IV2LS (4)
Δ Log outsourcing	0.028*	0.027*	0.063***	0.060***
	(0.017)	(0.017)	(0.016)	(0.015)
Δ Log openness-rate	0.087	0.088	0.109**	0.108**
	(0.058)	(0.058)	(0.057)	(0.057)
Δ TFP	0.045**	0.044**	0.064***	0.056**
	(0.020)	(0.021)	(0.017)	(0.027)
Δ Log technology share	0.004	0.005	0.002	0.004
	(0.024)	(0.024)	(0.036)	(0.035)
Δ Log Y		0.141**		0.156***
		(0.063)		(0.067)
Δ Log tariffs		- 0.014		- 0.002
		(0.010)		(0.009)
Δ Log material cost		0.016		0.018
		(0.031)		(0.029)
Δ Log Capital expenditure		0.038*		0.069*
		(0.022)		(0.026)
Industry fixed effects	yes	yes	yes	yes
R2	0.89	0.91	0.94	0.96
Observations	1703	1703	1818	1818
IV tests: Hansen J	0.18	0.55	0.64	0.66
Weak identification	3630.19	3681.90	9561.90	9577.02
Underidentification	0.000	0.000	0.000	0.000
Chow test		**0.000**		

Notes. All regressions were estimated using the 2SLS estimator. The instruments are: capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 8: Dependent variable: Δ Log (Total effect)

Explanatory variables	**1958-1983**: IV2LS (1)	IV2LS (2)	**1983-2005 :** IV2LS (3)	IV2LS (4)
Δ Log outsourcing	- 0.024*	- 0.017*	- 0.043**	- 0.032**
	(0.016)	(0.010)	(0.021)	(0.011)
Δ Log openness-rate	0.021	0.018	0.032	0.031
	(0.053)	(0.037)	(0.077)	(0.045)
Δ TFP	0.084***	0.065***	0.057**	0.048***
	(0.010)	(0.013)	(0.017)	(0.015)
Δ Log technology share	0.034	0.027	0.026	0.020
	(0.026)	(0.014)	(0.011)	(0.018)
Δ Log Y		0.028***		0.055***
		(0.012)		(0.013)
Δ Log tariffs		- 0.011*		- 0.007
		(0.006)		(0.006)
Δ Log material cost		0.022***		0.012***
		(0.007)		(0.009)
Δ Log Capital expenditure		0.035***		0.051***
		(0.005)		(0.002)
Industry fixed effects	yes	yes	yes	yes
R2	0.11	0.85	0.38	0.81
Observations	1541	1541	1719	1719
IV tests: Hansen J	0.24	0.30	0.21	0.22
Weak identification	8143	8160	8772.92	8255.65
Underidentification	0.000	0.000	0.000	0.000
Chow test		**0.000**		

Notes. All regressions were estimated using the 2SLS estimator. The instruments are: capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 – 2003 and 1983-2005 . * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 9: Dependent variable: Δ Log (Total employment)

Explanatory variables	**1958-1983**: IV2LS (1)	**1983-2005 :** IV2LS (2)
Δ Log outsourcing	0.028*	0.079***
	(0.015)	(0.015)
Δ Log openness-rate	0.032	0.060
	(0.036)	(0.067)
Δ TFP	0.029*	0.052***
	(0.017)	(0.013)
Δ Log technology share	0.023	0.028
	(0.019)	(0.035)
Δ Log Y	0.043*	0.065**
	(0.023)	(0.031)
Δ Log tariffs	- 0.010*	- 0.021*
	(0.005)	(0.011)
Δ Log relative wages gap		
Δ Log relative employment gap		
Industry fixed effects	yes	yes
R2	0.53	0.5355
Observations	1161	1161
IV tests: Hansen J	0.79	0.19
Weak identification	24308	23469
Underidentification	0.005	0.000
Chow test	**0.001**	

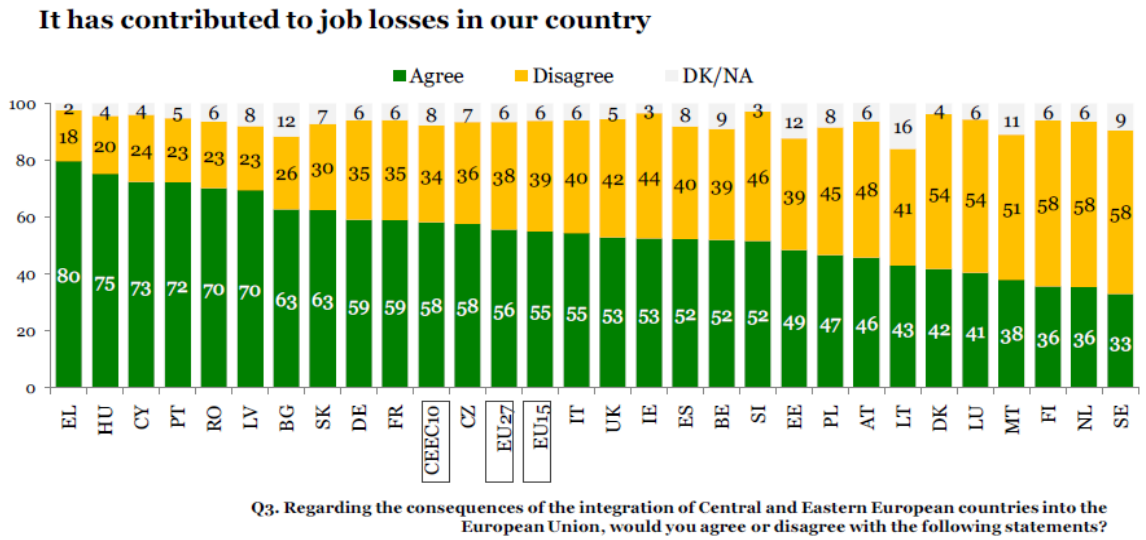
Notes. All regressions were estimated using the 2SLS estimator. The instruments are: production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Table 10: Dependent variable: Δ Log (Non-production workers share / total employment):)

Explanatory variables	**1958-1983**: IV2LS (1)	**1983-2005 :** IV2LS (2)
Δ Log outsourcing	0.011*	0.019***
	(0.007)	(0.005)
Δ Log openness-rate	0.015	0.016*
	(0.010)	(0.009)
Δ TFP	0.019***	0.026**
	(0.007)	(0.013)
Δ Log technology share	0.036	0.027
	(0.075)	(0.034)
Δ Log Y	0.015**	0.018***
	(0.007)	(0.005)
Δ Log tariffs	- 0.010	- 0.024**
	(0.008)	(0.011)
Δ Log relative wages gap		
Δ Log relative employment gap		
Industry fixed effects	yes	yes
R2	0.5435	0.5457
Observations	2139	2139
IV tests: Hansen J	0.99	0.18
Weak identification	4033	24308
Underidentification	0.001	0.000
Chow test	**0.001**	

Notes. All regressions were estimated using the 2SLS estimator. The instruments are: production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 - 1983 and between 1983-2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

Figure 1



Source: Eurobarometer "Views on European Union enlargement" 2009

Figure 2

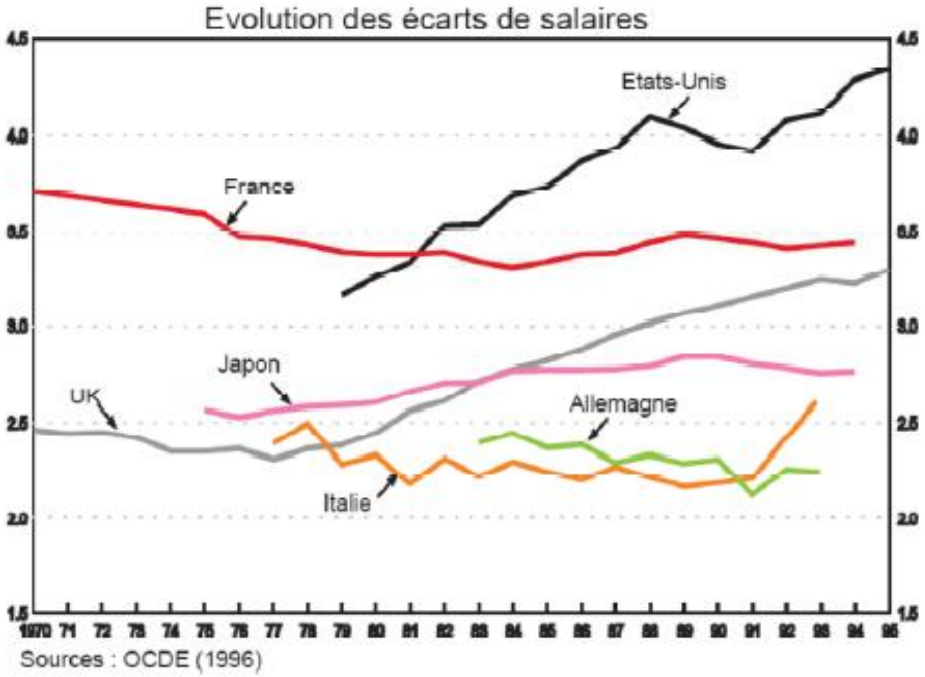
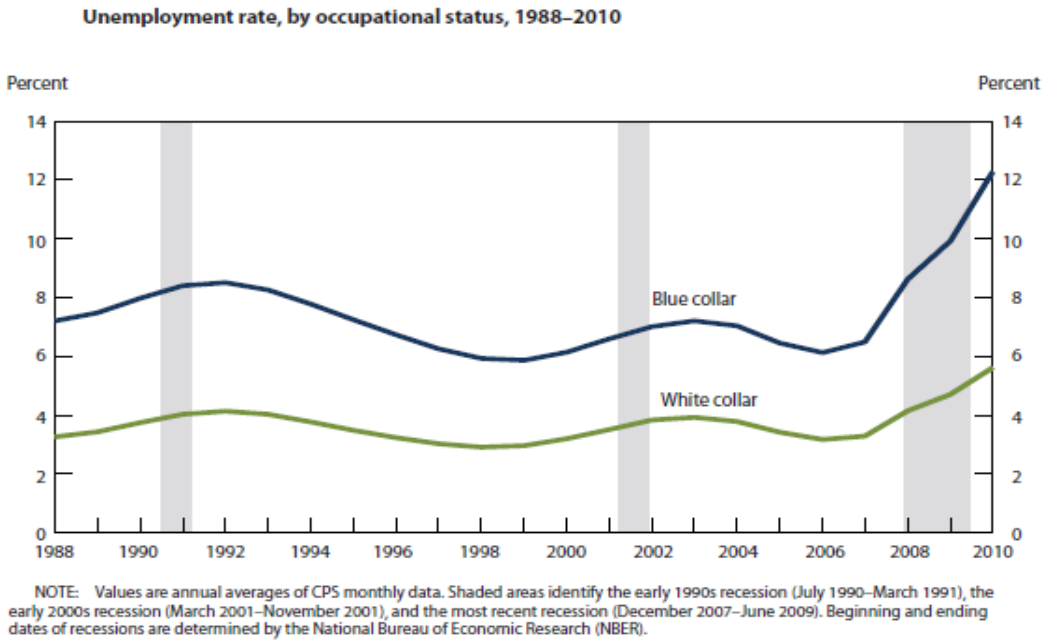
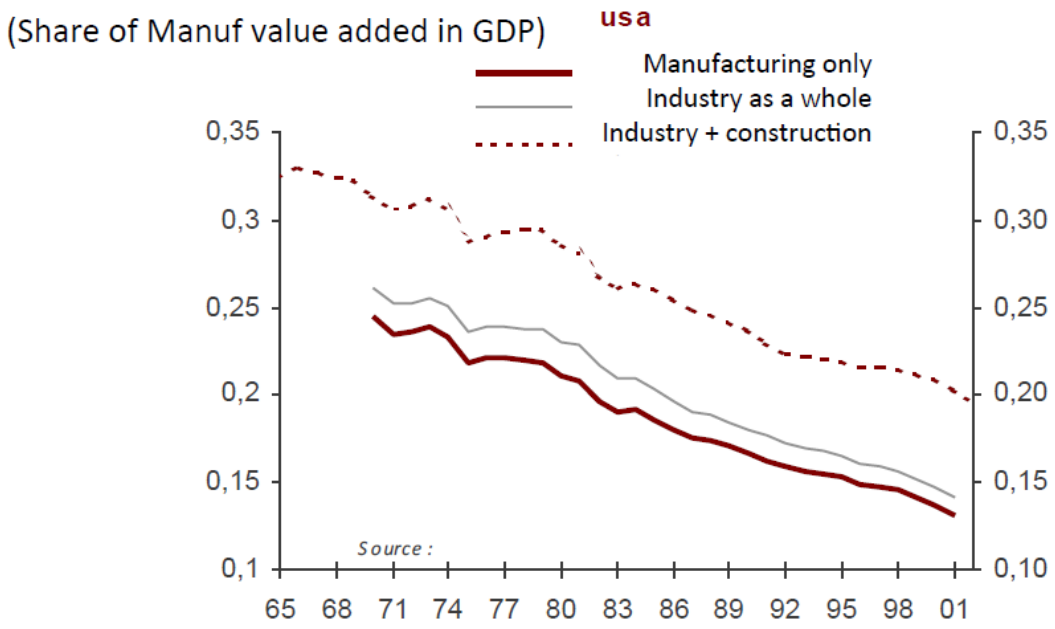


Figure 3



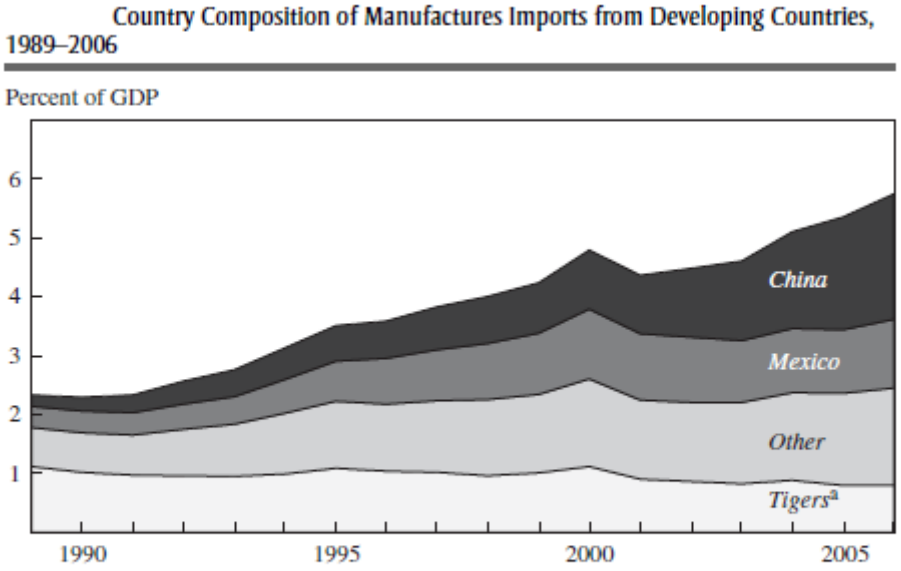
Source: Marios Michaelides and Peter R. Mueser, Monthly Labor Review, July 2012

Figure 4



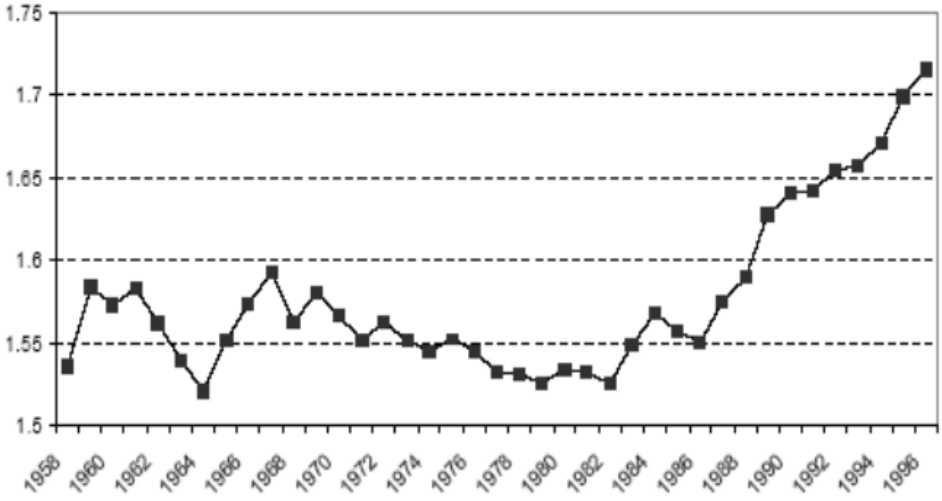
Source: US. Bureau of Labor Statistics.

Figure 5



Sources: U.S. International Trade Commission DataWeb and author's calculations.
a. Hong Kong, Singapore, South Korea, and Taiwan.

Figure 6



Relative wage of non-production / production workers, U.S. manufacturing

Source: NBER data, Feenstra, 2005

Figure 7

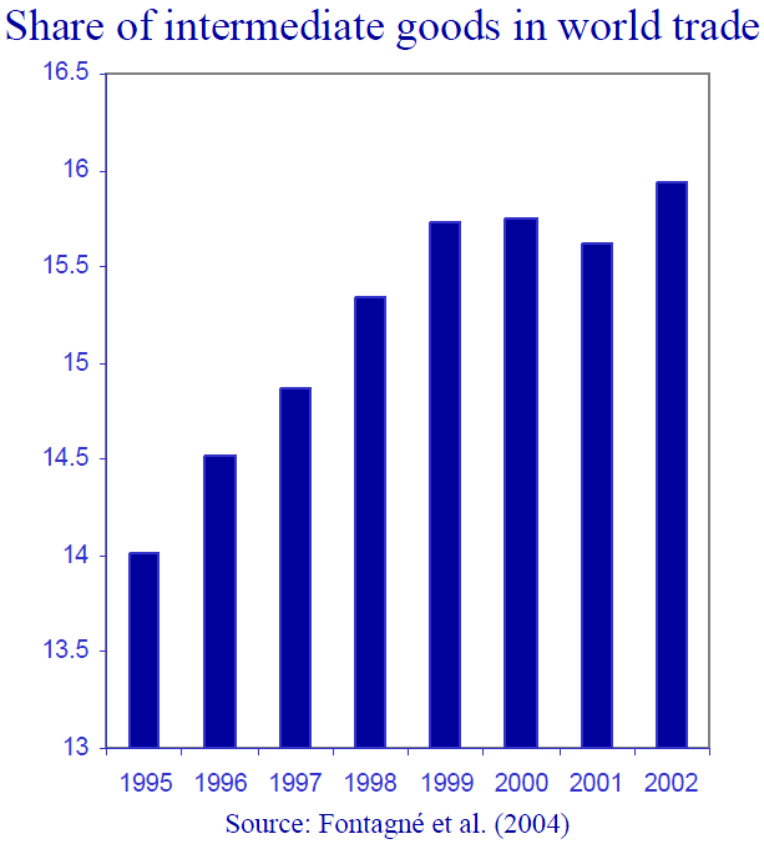
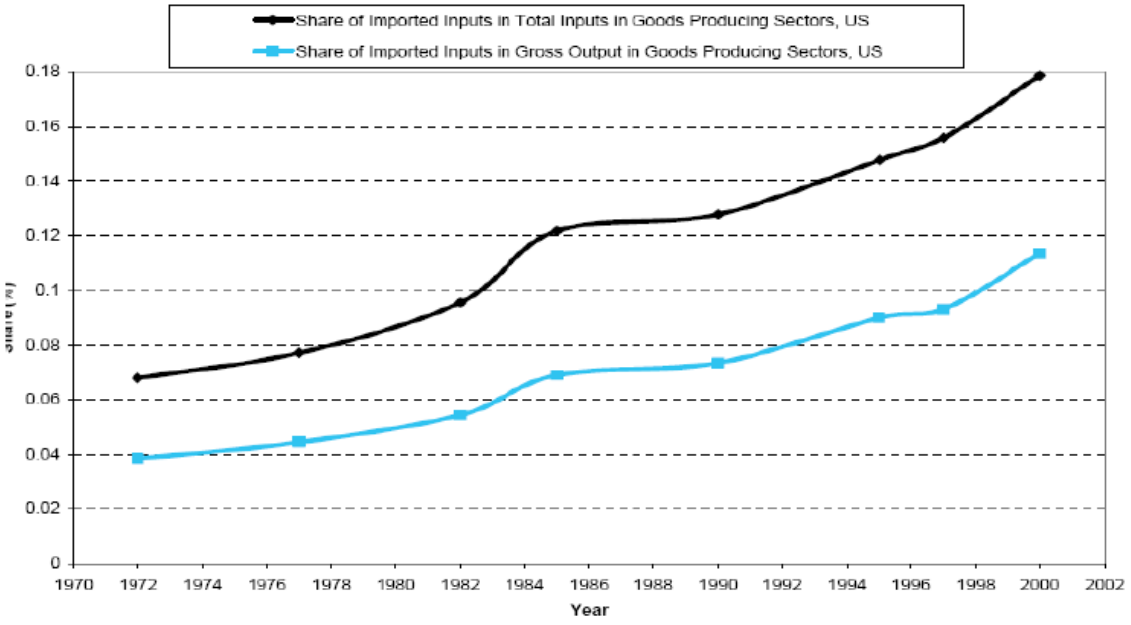
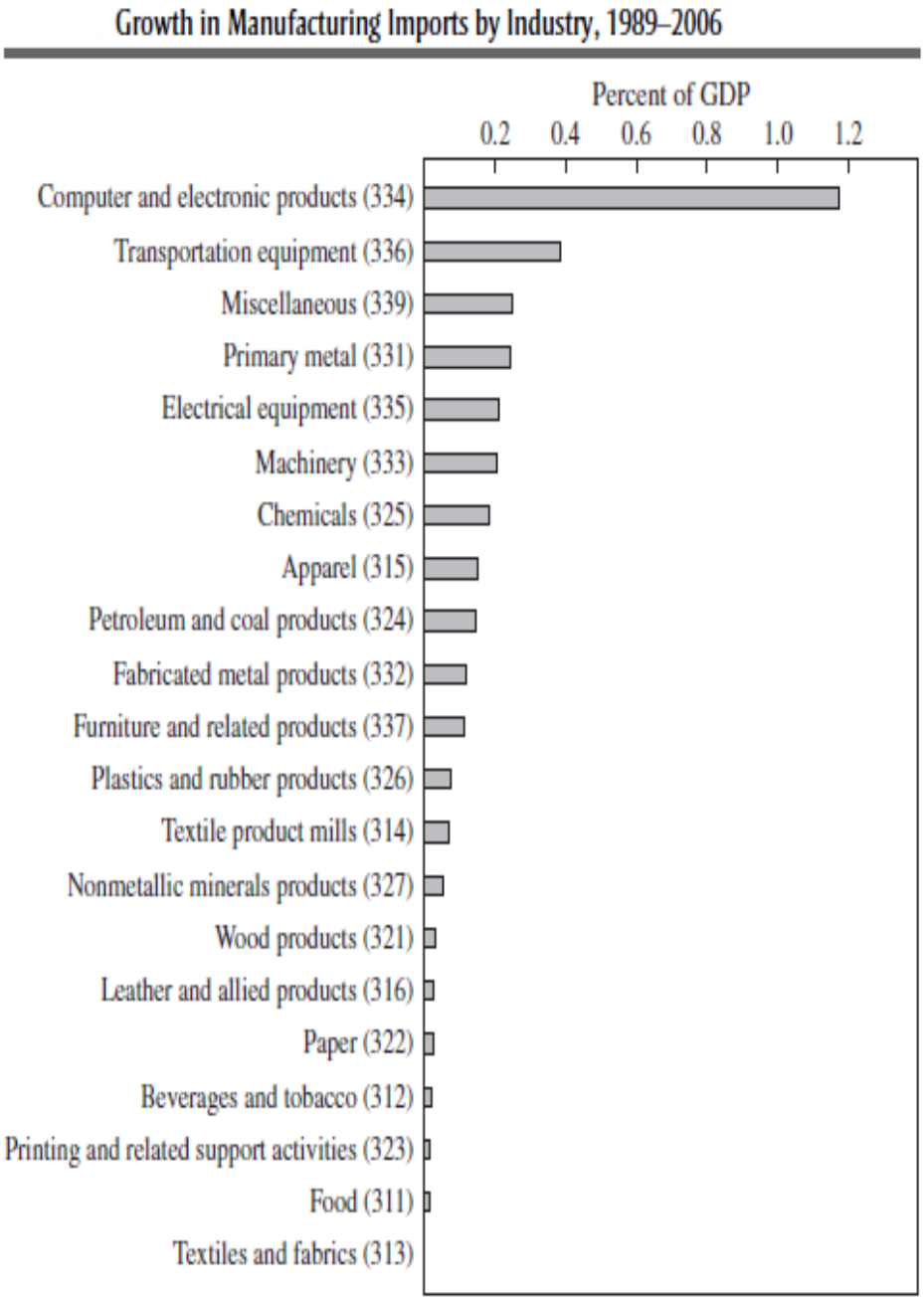


Figure 8



Source: Grossman and Rossi-Hansberg, "The Rise of Offshoring: It's Not Wine for Cloth Anymore"

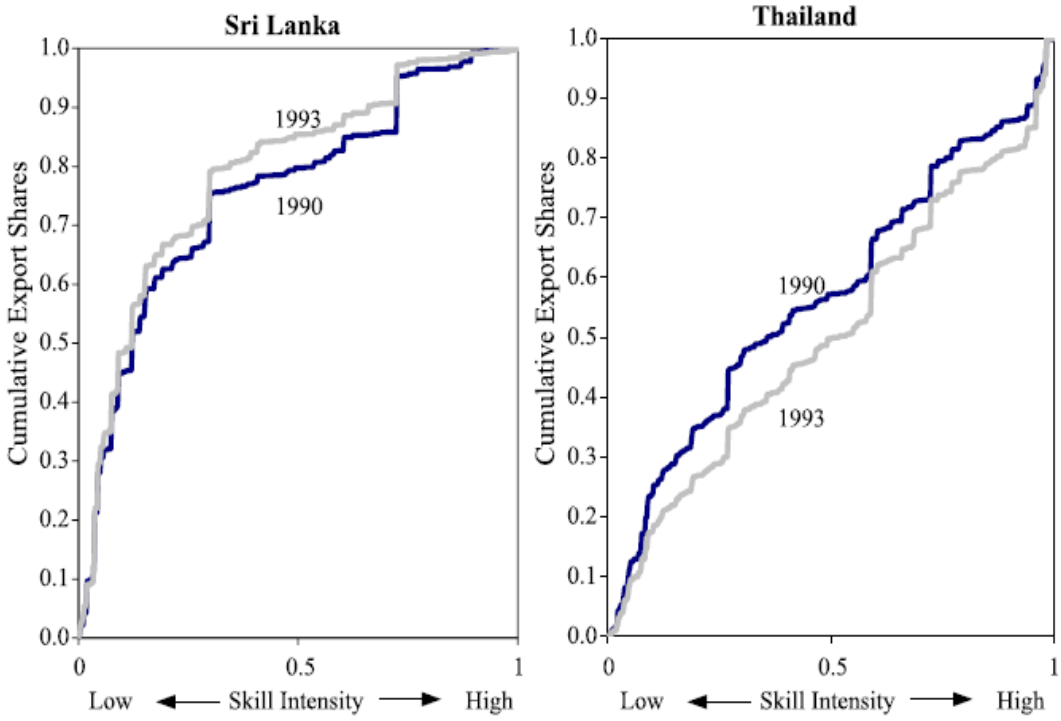
Figure 9



Sources: U.S. International Trade Commission DataWeb and author's calculations.

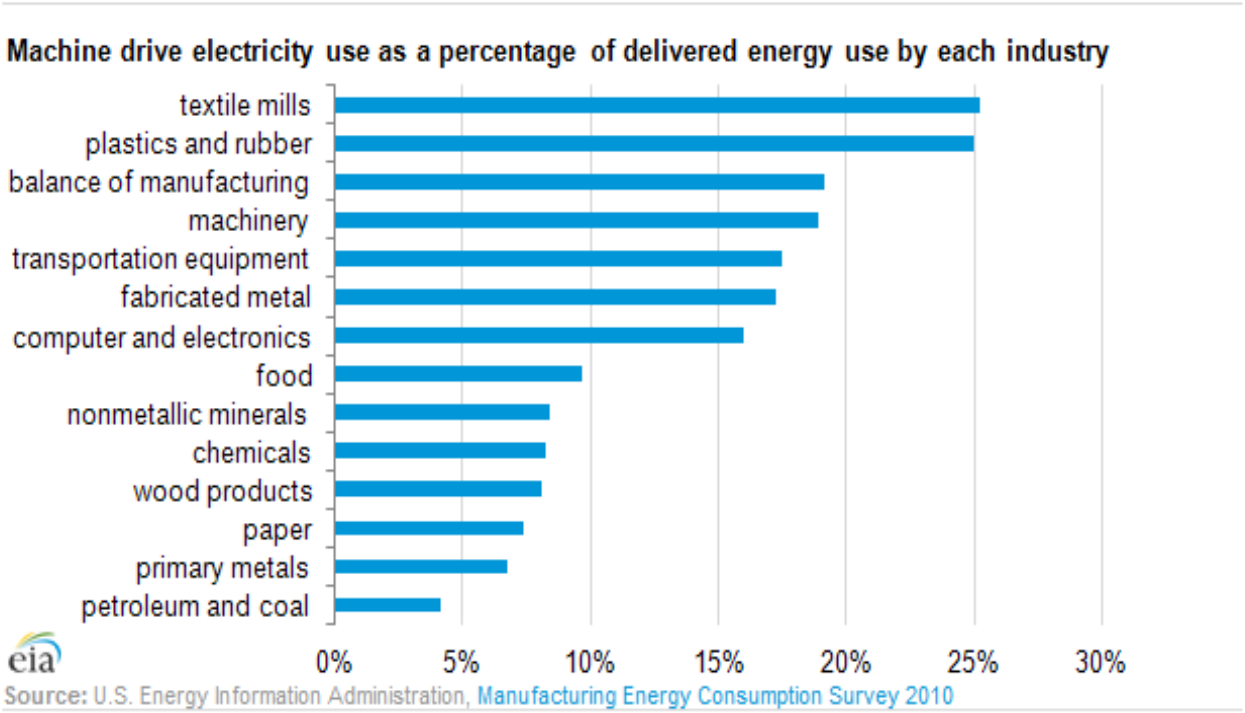
Figure 10

Change in the specialization



Source: Zhu and Trefler (2005)

Appendix


Machine drive electricity use as a percentage of delivered energy use by each industry
textile mills
plastics and rubber
balance of manufacturing
machinery
transportation equipment
fabricated metal
computer and electronics
food
nonmetallic minerals
chemicals
wood products
paper
primary metals
petroleum and coal
0%
5%
10%
15%
20%
25%
30%
eia
Source: U.S. Energy Information Administration, Manufacturing Energy Consumption Survey 2010

1: Dependent variable: Δ Log (Outsourcing): 1958-2005

Explanatory variables	IV2LS (First stage)
Δ Log openness-rate	0.012 (0.024)
Δ TFP	0.082*** (0.007)
Δ Log technology share	0.015 (0.019)
Δ Log Y	0.021 (0.025)
Δ Log tariffs	- 0.005 (0.004)
Δ Log material cost	- 0.019 (0.012)
Δ Log Capital expenditure	0.008 (0.012)
Δ energy cost	0.016** (0.008)
Δ capital intensive	0.014** (0.007)
Δ production workers' productivity	- 0.009*** (0.004)
Δ labor cost of production workers	0.017** (0.007)
Industry fixed effects	yes
R2	0.44
Observations	2283

IV tests: F test P-val: 0.000
Angrist-Pischke multivariate F test of excluded instruments: 0.000

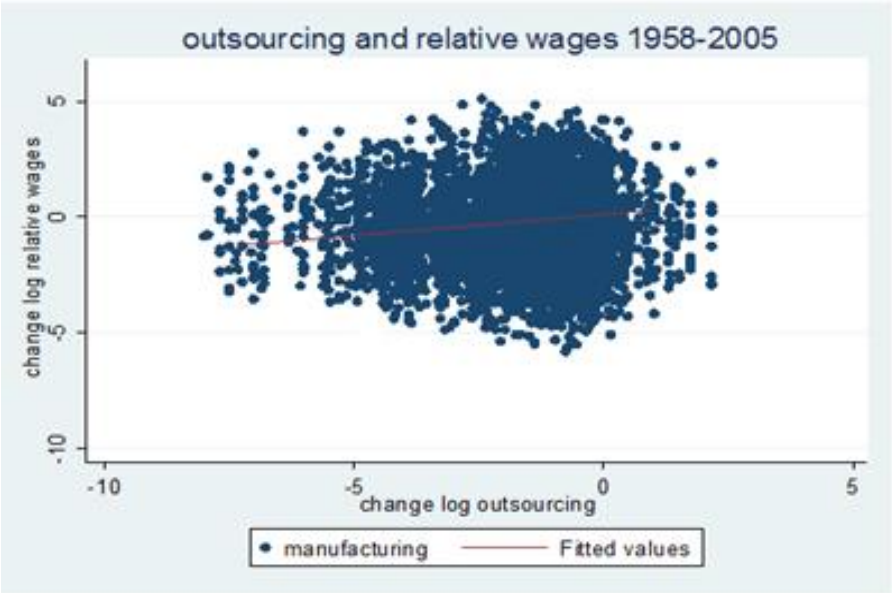
Notes. The instruments are: the capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.

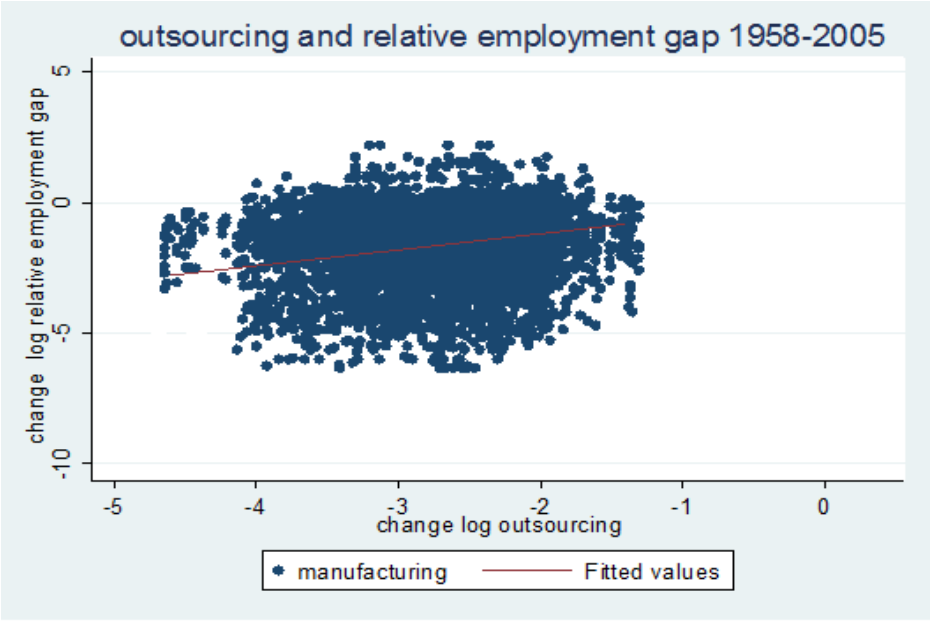
2: Dependent variable: Δ Log (Outsourcing): 1958-2005

Explanatory variables	IV2LS (First stage)
Δ Log openness-rate	0.028 (0.047)
Δ TFP	0.082*** (0.007)
Δ Log technology share	0.015 (0.019)
Δ Log Y	0.016* (0.010)
Δ Log tariffs	- 0.013* (0.007)
Δ Log wage gap	- 0.025*** (0.012)
Δ Log employment gap	0.013 (0.012)
Δ energy cost	0.014*** (0.006)
Δ production workers' productivity	- 0.006*** (0.002)
Industry fixed effects	yes
R2	0.51
Observations	2294

IV tests: F test P-val: 0.000
Angrist-Pischke multivariate F test of excluded instruments: 0.000

Notes. The instruments are: the capital intensive, labor cost of production workers, production workers' productivity and the energy cost. All variables are expressed in logarithms. Standard errors (in parentheses) are robust to heteroskedasticity. The sample used in estimation consists of 459 manufacturing industries between 1958 and 2005. * Significance at the 10% level. ** Idem, 5%. *** Idem, 1%.


outsourcing and relative wages 1958-2005
change log relative wages
5
0
-5
-10
-10
-5
0
5
change log outsourcing
manufacturing
Fitted values


outsourcing and relative employment gap 1958-2005
change log relative employment gap
5
0
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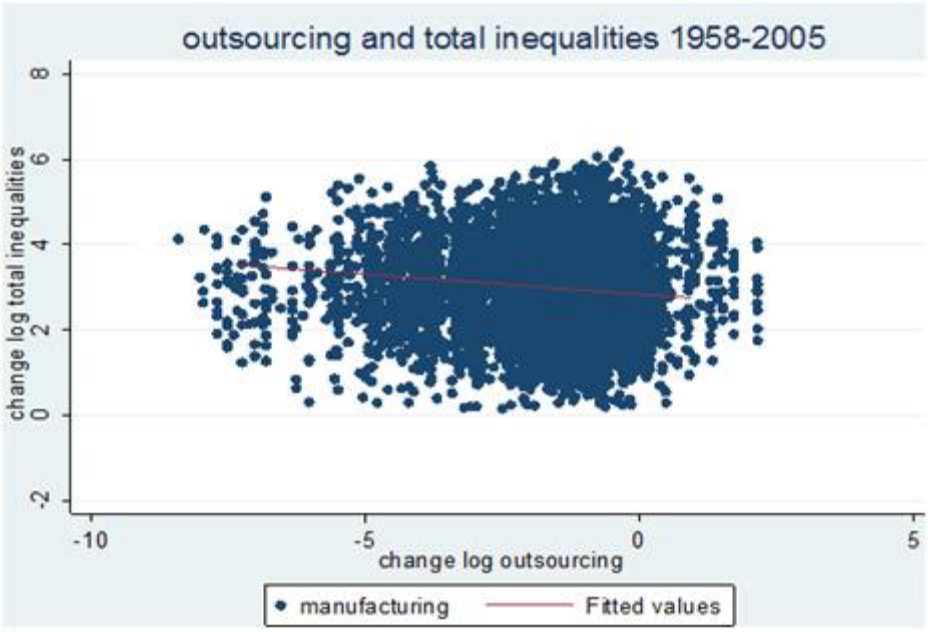
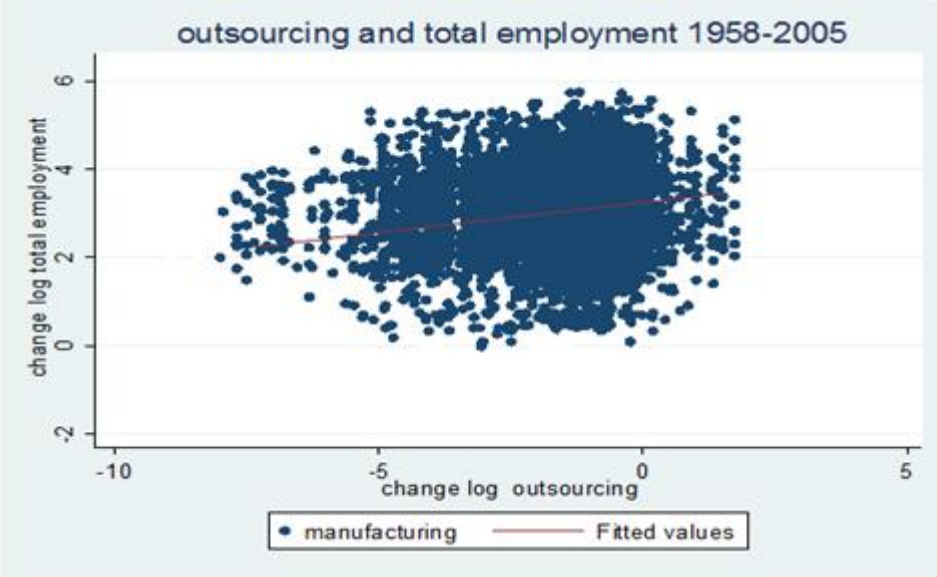
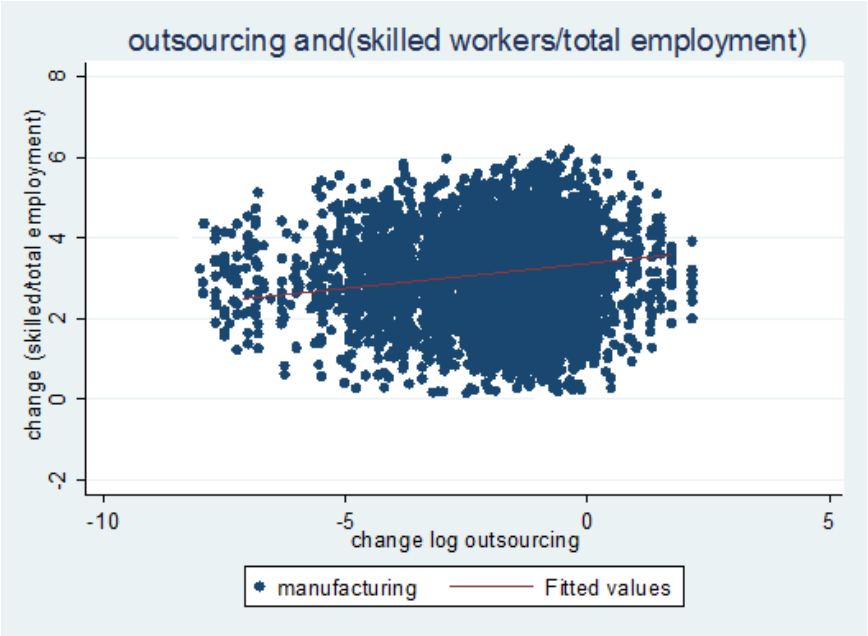
-10
-5
-4
-3
-2
-1
0
change log outsourcing
manufacturing
Fitted values


outsourcing and total inequalities 1958-2005
change log total inequalities
-2
0
2
4
6
8
-10
-5
0
5
change log outsourcing
manufacturing
Fitted values


outsourcing and total employment 1958-2005
change log total employment
-2
0
2
4
6
-10
-5
0
5
change log outsourcing
manufacturing
Fitted values


outsourcing and(skilled workers/total employment)
change (skilled/total employment)
-2
0
2
4
6
8
-10
-5
0
5
change log outsourcing
manufacturing
Fitted values